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ABSTRACT

This guide, the first in a series of three, provides the intermediate science student and teacher an opportunity to review selected science concepts and processes through activities which emphasize the applicability of scientific knowledge in the professional world. The three components in this guide deal with (1) ecology (what marine science workers do, environmental problems in marine science, and ecological factors in marine science); (2) health (functions and characteristics of cells, the results of improper nutrition, and selected jobs in the health field); and (3) the need for communication and measurement skills in construction careers. The activities in each of the components reinforce the student's skills in processes such as classifying, interpreting data, and controlling variables. Each activity contains an objective, key words, and a listing of materials needed to complete the learning experience. Simple experiments that students can perform have been included when applicable. In addition, the teacher is provided with a step-by-step outline of suggestions on how to implement the activity. An optional section in each component entitled "Home and Community" provides projects for extending the skills and knowledge gained to those areas. (NCR)

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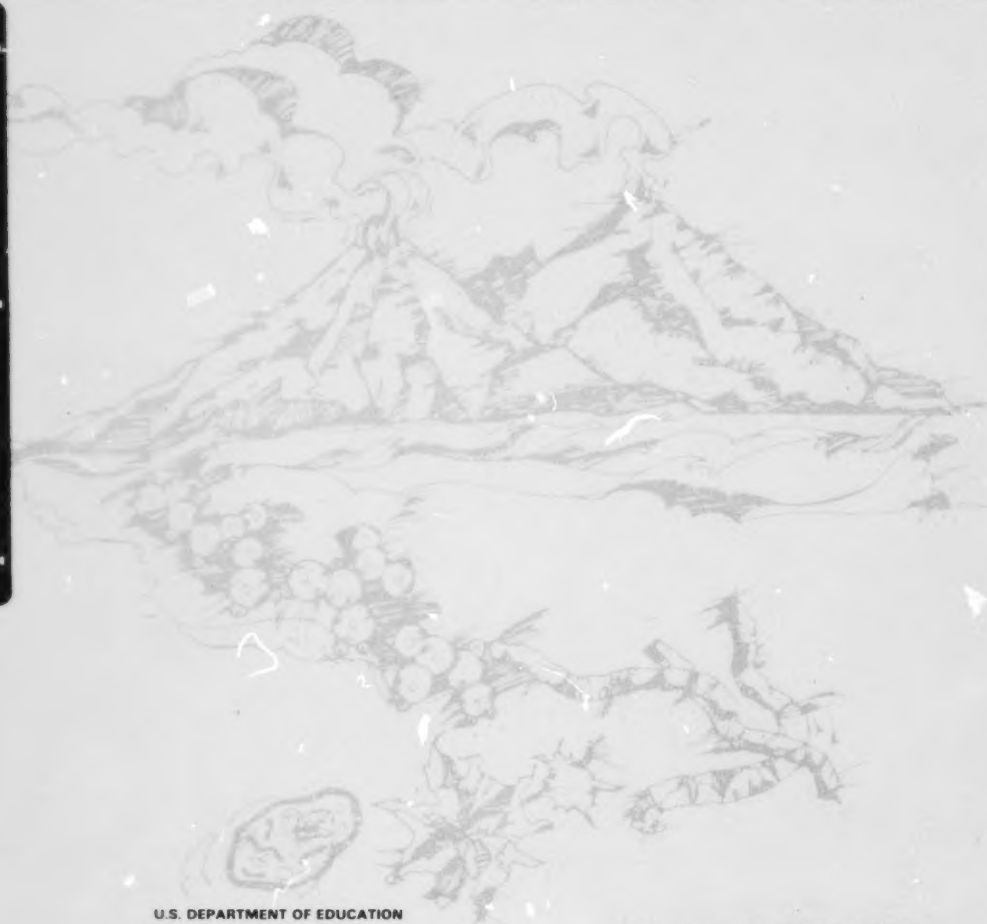
APPLIED BASIC CURRICULUM SERIES

Science

a practical view

Teacher Edition

Volume I



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INSTRUCTIONAL APPROACH

Science: A Practical View provides the intermediate science student and teacher an opportunity to review selected science concepts and processes through activities which emphasize the applicability of scientific knowledge in the professional world. The three activities in each of the three components reinforce the student's skills in processes such as classifying, interpreting data, and controlling variables. Each activity contains an objective, key words, and a listing of materials needed to complete the learning experience. Simple experiments that students can perform have been included when applicable. In addition, the teacher is provided with a step-by-step outline of suggestions on how to implement the activity. An optional section entitled Home and Community provides projects for extending the skills and knowledge gained to those areas. Since the components are independent and interchangeable, the teacher may select those which best meet the needs of the students. They may be presented as they are structured or reordered in another manner. The content also affords students with insight into his or her personal interests and abilities as they relate to preparation for the future. It is hoped that educators will find the materials helpful and motivational.

Component 1

Section One

Section Two

Section Three

OUR ECOLOGY

OVERVIEW

This component is designed to reinforce the students' understanding of the principles of ecology. These principles are given in the context of their relationship with aspects of Marine Science. Section One presents three careers in the Marine Science Cluster. Section Two deals with the problems caused by man to marine ecology by thoughtless exploitation. The environmental factors that affect marine life are outlined in Section Three.

GOALS

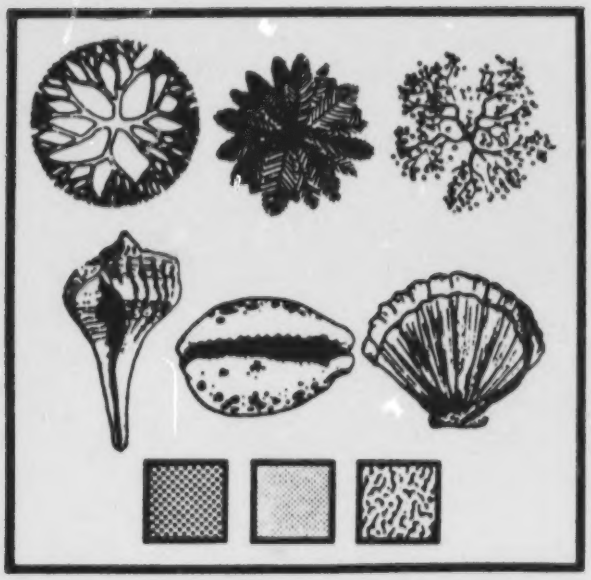
CLASSIFYING:	The student will understand the principles of ecology by naming the factors which function as controls on the size of populations.
INTERPRETING DATA:	The student should have a positive attitude toward conservation of environmental resources and toward the conservation of human resources.
CONTROLLING VARIABLES:	The student will show understanding of ecological principles as controlled by factors affecting the environment and the population.

LEARNING SECTIONS

SECTION 1: What Marine Science Workers Do

SECTION 2: Environmental Problems in Marine Science

SECTION 3: Ecological Factors in Marine Science



COMPONENT I

Section One

Section One
What Marine Science Workers Do

Key Words

. resources

. compete

. environment

. supervise

. algae

Learning Objective

Using three narratives based on jobs related to the principles of ecology as shown in the Marine Science Cluster, the student will associate each activity with a corresponding career with a 70% accuracy.

Materials

. copies of introduction

. copies of three narratives

. copies of review lesson

Domains and Levels

Cognitive Knowledge, Comprehension, Analysis

Affective Receiving, Responding, Valuing

IMPLEMENTATION GUIDELINES

Time: *1 Class*

STEP I - A short introduction, "Man and the Ocean," and three short narratives present the student with career opportunities in Marine Science. The careers presented are:

Tool pusher for Offshore Drilling Rig (930.170)
Fish Culturist (Fish Hatchery Supervisor) (041.168)
Fish Hatchery Worker (436.181)

These describe various types of Marine Science careers and give a summary of working conditions connected with three specific careers. The narratives also indicate that these workers use science in their jobs.

STEP II - The narratives may be read aloud by the teacher or by a student to the group. If the teacher prefers, the narratives may be read individually by the student.

STEP III - The teacher may ask various students to comment on the narratives and encourage the students to ask about anything they don't understand.

STEP IV - Further discussion might be elicited by asking the students which worker used science concepts. A worksheet is provided.

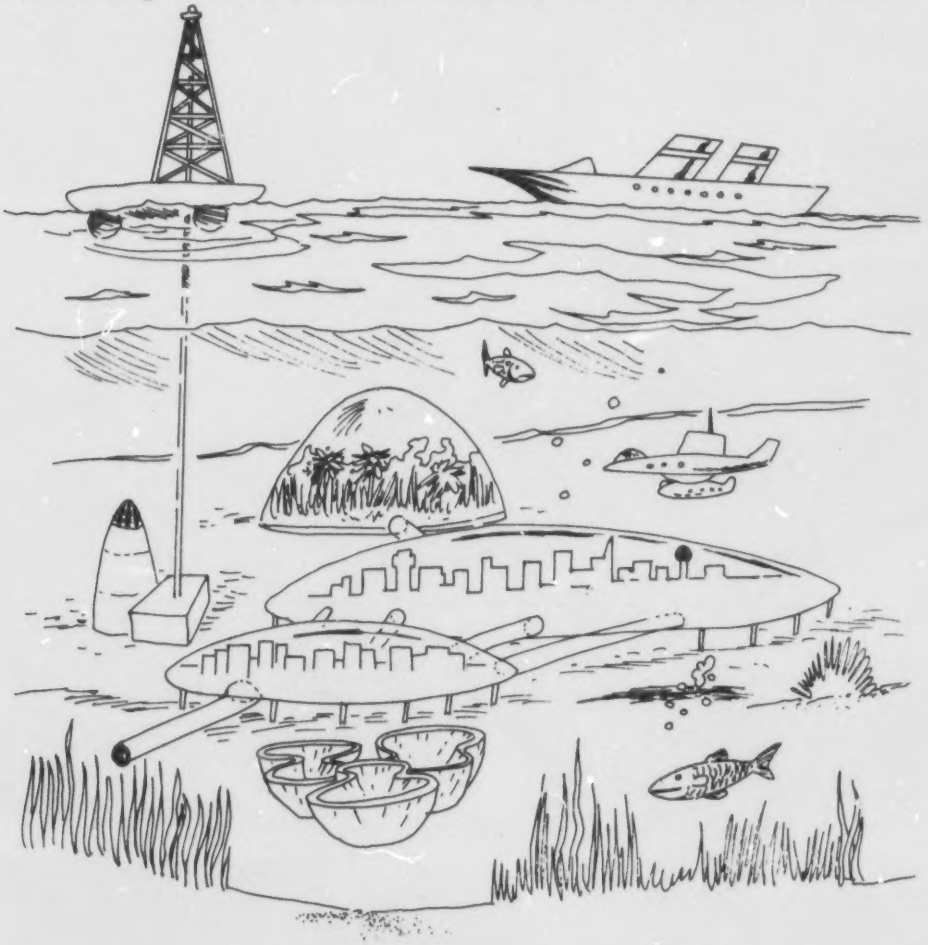
STEP V - After completing the lesson, the student should do the evaluation, a short activity to determine comprehension of materials studied. The teacher may check this inventory, or the student may, using the key provided.

STEP VI - The Home and Community section is optional. It may be assigned if there is sufficient time.

STUDENT ACTIVITY MATERIAL

Introduction

Homo Sapiens, which means man, is an "endangered species." The fast growing population of the planet Earth is exhausting its land, minerals, and food supply. New resources must be found if human kinds is to survive. One source of these new resources is the ocean. Nearly 3/4 of Earth is covered with water. Science and industry are working to develop this new frontier. Persons working in the Marine Science field are finding out about life as it exists in a water environment.



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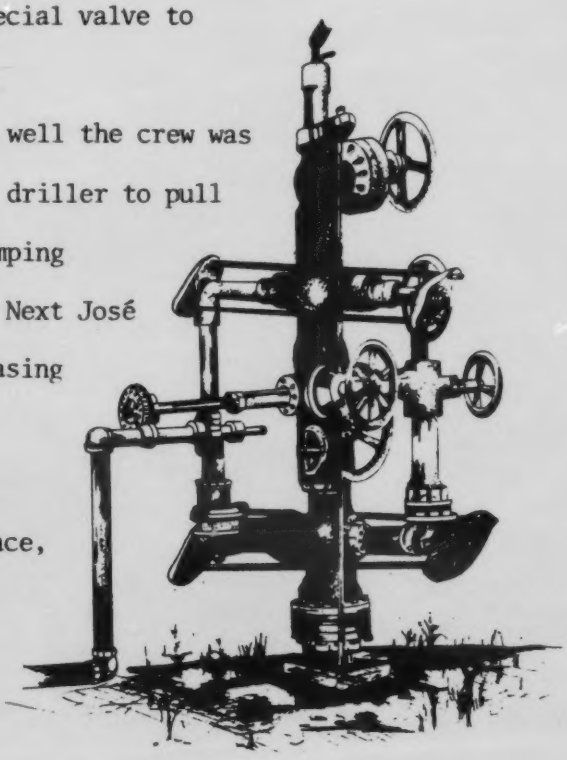
All living things have the same basic needs: food, water, oxygen, sunlight and an optimum temperature. Living things compete in their environment for these needs. The factors which limit these needs are overpopulation, pollution, and disease. They determine the number of species that can live in a particular environment.

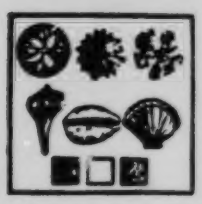
Marine Science is the name of a group of jobs related to the discovery, cultivation and harvesting of food and minerals from fresh and ocean waters. Fishing and fish farming, from fresh or salt water, will provide jobs in the future. Mining minerals and chemicals from the ocean floor will provide new sources of energy. Growing sea plants, such as algae or kelp, now provides food for more and more of the population. In the future, people called "aquanauts" may live in self-contained communities located on the ocean floor.

José Ruíz

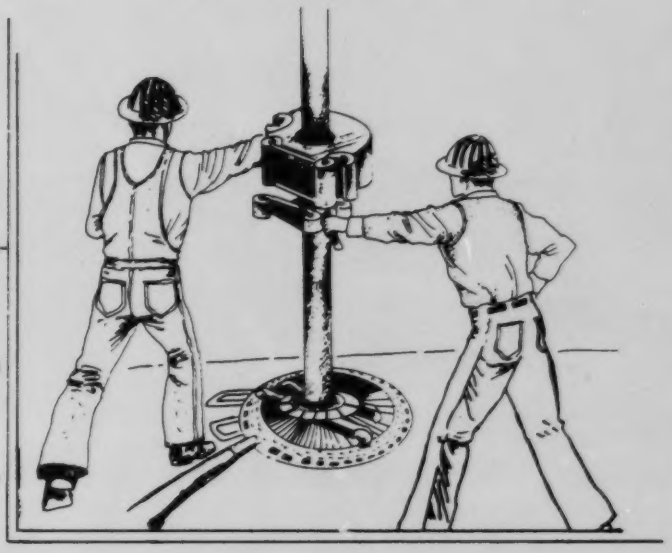
José Ruíz is a tool pusher for Pacific Oil Company. He works on an offshore rig located in the Gulf of Mexico. José supervises the work of the drilling crews on the rig. He orders the drilling tools that the crews might need. One of his duties is to direct the crews in mixing the drilling mud and the circulating mud used in the borehole. The drilling mud is a special mixture of clay, water, and chemicals. This mud causes rock cuttings to come to the surface. It also lubricates and cools the drill bit. A special drilling mud must be used to prevent a blow out when the well is ready to produce. He knows blow-outs waste valuable oil. When the well is ready to come in, he orders the installation of the special valve to control the well flow.

Today was a busy day for José. The well the crew was drilling came in. He first directed the driller to pull the drill pipe and bit from the lower pumping casing. They cemented this into place. Next José supervised fastening of the tubing and casing to a special system of valves called the "Christmas Tree." Pressure in the well forced the crude oil and gas to the surface, through the Christmas tree, into gas traps and oil storage tanks. Sometimes the pressure is not enough and pumps are needed to bring up the oil.





José is proud to work for Pacific Oil Company. His crew takes care not to disturb the environment around the drilling platform. They use special pipes and casings to prevent the drilling mud and oil from spilling into the ocean. The diesel motor which operates the machinery is housed in a special shed to prevent the diesel fuel from polluting the water.



The drilling platform itself provides a complete environment for a community of sea life. Algae grow on the legs of the platform providing a basis for the web of life beneath the rig. The sea animals eat the algae and find protection in the flowing green mass. Jelly fish, floating nearby, trap these fish in their tentacles. José thinks, "It is a never ending chain of life."

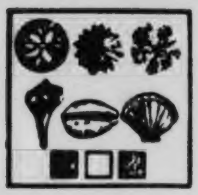
Juana Martin

Juana Martin is a fish hatchery superintendent. She supervises a large government fish hatchery and farm in Washington. Her fish farm supplies salmon for stocking lakes and streams in the Pacific Northwest.

She studies water conditions where the fish breed naturally and duplicates these conditions on the fish farm. It is important that the temperature, oxygen and light for the hatching and rearing ponds to be the same as where the fish live naturally. She is responsible for collecting the spawn (fish eggs) and caring for the fry (young fish). She supervises the feeding and sorting of the fish according to size. She arranges for transportation of the young fish when they are ready to be released in the streams and lakes.

One important duty is to maintain the right oxygen content in the tanks and ponds where the young fry live. Fish must have oxygen to live. They take dissolved oxygen from the water with their gills. If there is too little oxygen, the fish will die.

Today Juana is checking the oxygen content of her salmon ponds. She carries two collecting beakers and chemicals, manganese sulfate and sodium hydroxide. First, she



fills her large beaker with 100 ml. of water from the pond. Then she mixes 2 ml. manganese sulfate and sodium hydroxide. She adds the mixture of manganese sulfate and sodium hydroxide to the 100 ml. of pond water. Next, she puts a solid rubber stopper in the beaker and shakes it firmly. A powdery material called a precipitate settles to the bottom of the beaker. She studies the precipitate to determine the oxygen content. A white precipitate means no oxygen. A light yellow precipitate means poor oxygen. A medium yellow precipitate means medium oxygen. A brown precipitate means good, rich oxygen. Fish can live in water with a medium or rich oxygen content. Juana sees the precipitate in the beaker is brown. What does this tell her about the oxygen content of the pond water?

Now she must get ready for the trucks that will come tomorrow to take the salmon fingerlings. They will be taken to tributaries of the Columbia River to be released. These small fish will eventually find their way to the Pacific Ocean. There they will spend their adult life, returning in 3 years to the place where they were released. There the adults will spawn, and the cycle of life will begin anew.

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FISH CATCHERY

WORKER

María Carter likes her job as a fish hatchery worker. She works in a state fish hatchery near Tishimingo, Oklahoma. The hatchery raises bass, trout and catfish. These fish are released in the various streams in Oklahoma to increase the supply of game fish in the state.

Today, María spent part of her day in the incubating rooms. First she stripped eggs from the female fish. She carefully arranged the eggs, or spawn, on moist trays. She removed the diseased eggs and treated them with special chemicals. She discarded any eggs not able to be fertilized. Next she completely covered the spawn with milt, the reproductive glands and semen stripped from the male fish. This

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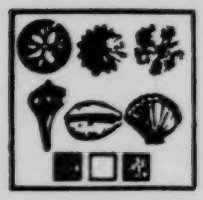
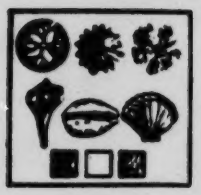


fertilized the eggs. She watched the eggs carefully. When they swelled and hardened they were fertilized. She then washed the remaining milt from the fertilized eggs and removed them to hatching boxes where oxygen rich water flowed constantly. There the eggs will remain until the young fry hatch. She also checked the temperature of the water to be sure it was right.

María took several trays of newly hatched fry to the rearing ponds outside. There she fed them the high protein diet given all the hatchery fish: ground beef, liver, slaughter house waste and daphnia, small water fleas grown at the hatchery as fish food.

She fed the other fish and checked each pond to be sure the young fry were healthy. When she found any diseased fish, she removed them from the growing ponds and placed them in special treatment ponds. She also removed any fish showing abnormal growth or malformations.

Today she also helped clean the growing ponds to remove excess algae, waste material and dead matter. María also counted the fish in each pond and recorded the growth of the fish on her charts. She sorted some of the larger fry, putting all the young fish of one size in the same pond. She prepared several ponds for pick-up tomorrow. These fry had reached the size to be released in the various streams in the state. Trucks would be at the hatchery early in the morning to pick them up.



Exercise

Directions: Circle the correct job activity for each worker.

1. A tool pusher on an offshore drilling rig

   a. uses special pipe and casing to prevent oil from seeping into the ocean.

   b. studies water conditions where fish live.

   c. cleans fish tanks and ponds.

2. A fish hatchery superintendent

   a. supervises mixing of special drilling mud.

   b. maintains proper oxygen content in water for young fry.

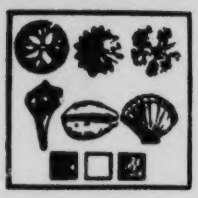
   c. counts and sorts fish according to size.

3. A fish hatchery worker

   a. orders drilling supplies for offshore drilling rig.

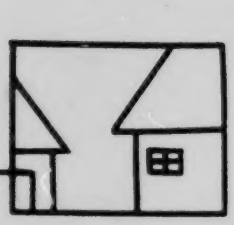
   b. arranges transportation of fish from hatchery to streams and lakes.

   c. covers eggs with milt from male fish to fertilize them.



Exercise Key

1. a
2. b
3. b



HOME and COMMUNITY

HOME: The student may talk to members of the family. If any family member works in a Marine Science field, i.e. oil field worker, commercial fisherman, marine geologist, conduct an interview on job related working conditions. The student may research food the family eats that comes from the sea. The student may watch T.V. programs such as Jacques Costeau. He or she may explain how Costeau's work is related to Marine Science.

COMMUNITY: Students may survey the neighborhood and friends; if any work in a Marine Science related field, interview them about their job's working conditions. Students may visit a Municipal Aquarium, and identify fresh and salt water fish, food and non-food fish. Students may plan a trip to a lake, sea or ocean and record the animal and plant life found. If there is a fish hatchery in the area, students may visit it and prepare a report to present to the class.

Students may research a specific food fish such as salmon or tuna and prepare a well-written report to present to the class. They may set up and maintain a balanced fresh water aquarium, either at home or in the classroom. A small 1 or 5 gallon glass tank is easily maintained and does not need special equipment, such as heat pumps or air circulation pumps. The equipment needed for setting up a small aquarium is:

A. Adequate gravel to cover 1" - 2" depth.

B. Aquatic plants such as Cabomba, Elodea or Sagittaria.

C. Chlorine removal drops, i.e. "Zip" drops

D. 3 or 5 small fish, depending on size of tank. Goldfish and Guppies are easiest to maintain. Do Not put Goldfish in same tank as Guppies.

E. Commercial fish food.

The students will keep the following records:

A. size of aquarium

B. number and kind of plants

C. number and kind of fish

D. location of tank; i.e. sunny window.

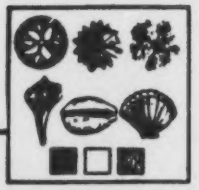
E. amount of food.

F. any changes in appearance of plants, fish or water.

G. appearance of algae growth.

If chemicals such as manganese sulfate and sodium hydroxide are available, the students may demonstrate the activity described in the fish hatchery supervisor narrative. Aquarium, pond, creek, or tap water may be used.

The students may develop a bulletin board activity showing Marine Science Careers. Pictures may be from magazines, newspapers or student sketches.



EVALUATION

I. Match each worker in list A with a job activity in list B. Put the letter of the worker named in list 1 in the space before the job activity in list 2.

A. Worker

A. Toll Pusher for Offshore Drilling Rig

B. Fish Hatchery Superintendent

C. Fish Hatchery Worker

B. Job Activities

___ 1. Feeds young fish a high protein diet.

___ 2. Arranges transportation of fish from hatchery to stream.

___ 3. Directs use of special pipe to prevent oil from seeping into ocean.

___ 4. Removes eggs from female fish.

___ 5. Supervises state fish hatchery.

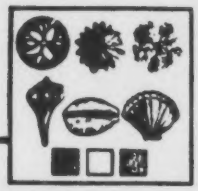
___ 6. Orders special drilling mud for wells.

___ 7. Cleans fish ponds to remove algae and waste matter.

___ 8. Checks oxygen content of pond water.

___ 9. Supervises work of drilling crews on offshore rig.

___ 10. Maintains proper temperature for hatching boxes.



EVALUATION

II. Answer the following:

1. Why is man called an "endangered species?" _____

_____

_____

2. Why are the oceans important to man? _____

_____

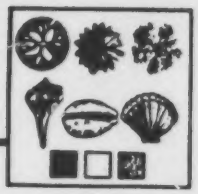
_____

3. Why is science important to a Fish Hatchery Superintendent? _____

_____

_____

EVALUATION



Evaluation Key

I. 1. c
2. b
3. a
4. c
5. b
6. a
7. c
8. b
9. a
10. c

II. 1. Because he is in danger. Man is overpopulating the earth and using up natural resources.

2. Accept any logical answers.

3. Because science courses help to prepare the worker to carry out work activities such as measuring the oxygen content in the water.

COMPONENT I
Section Two

Section Two

Environmental Problems in Marine Science

Key Words

- depleted
- predators
- overpopulation
- ice floe
- blubber
- slaughter
- cargo
- tanker
- oil spills

Learning Objective

Given two work problem situations in Marine Science that involve two opposing viewpoints, the student will demonstrate a positive attitude toward the conservation of environments, resources, and human resources with a 70% accuracy.

Materials

- one copy of each of the five articles for each student.
- copies of the exercise

Domains and Levels

Cognitive Comprehension, Knowledge, Analysis

Affective Receiving, Responding, Valuing, Organization

IMPLEMENTATION GUIDELINES

Time: *1 or 2 Classes*

This activity is designed to increase the student's awareness of environmental and ecological problems caused by man's use of the natural resources of earth. Two problems, the annual baby Harp Seal hunt in Canada and the effect of oil spills on the environment are presented.

After completing the activity the teacher may wish to further investigate these and related problems. Such related problems might be:

Whale hunting
Tuna fishing which endangers the porpoise
Destruction of marshlands

A class discussion would give the students a chance to air their views about these problems. These activities provide a forum for class debate. The following steps may be used:

STEP I - The teacher may read the "Additional Information" to the students or the students may read it individually. At this point, no comments should be made.

STEP II - After the teacher has read the introduction to the class, the students may form two groups. Each group should read either "Green Peace" or "The Hunt."

STEP III - The students may discuss the issues. The teacher should propitiate a calm and rational approach since the topic is an emotional one.

STEP IV - One student may write the conclusions of the group on the board.

STEP V - The same steps (2, 3, and 4) may be followed with "Pacífica Oil Company" and "Environmental Writer."

STEP VI - After the topic has been thoroughly discussed, the students may complete the exercise.

STEP VII - Evaluation

STEP VIII - If there is time, the teacher may have the students select and complete a Home and Community activity.

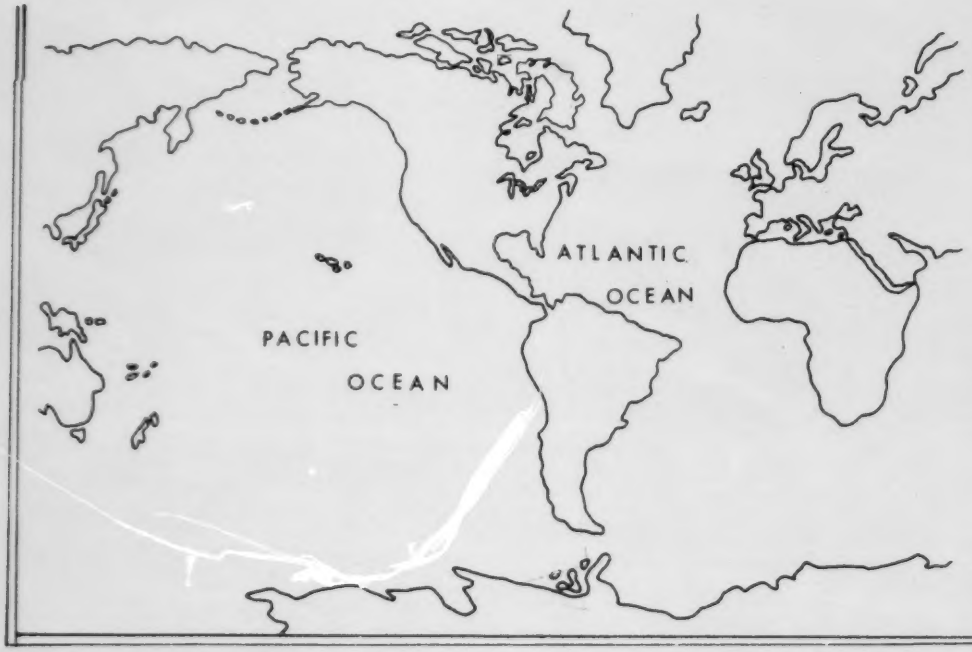
STUDENT ACTIVITY MATERIAL

Ecological Factors in an Eco-system

An eco-system consists of plants and animals living together in a specific environment. Certain factors act as controls on the size of populations in a particular eco-system:

1) the quality of water
2) the availability of oxygen
3) the presence of an optimum (best) temperature
4) the presence of sunlight
5) the amount of food

Water covers nearly 3/4 (76%) of Earth's surface, making it truly a water planet. The oceans contain most of this water. All Earth's water supply either originates in the ocean or eventually returns to the sea.



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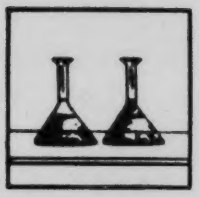
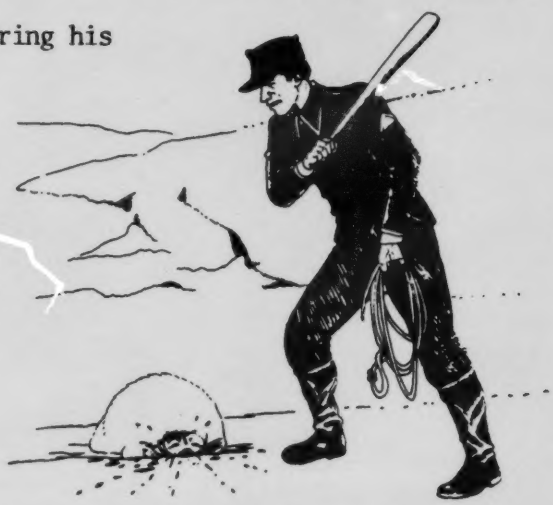


The Hunt

Today is the first day of the annual Baby Harp Seal Hunt. Sam Tobias is ready. He hopes to have a good hunt. He knows there are many day old baby seals on the nearby ice floe because he saw a large number of female seals return last week and heard the hungry cry of the new born pups.

Seal hunting is a 400 year old tradition in Sam's village. Every year for as long as Sam can remember the annual arrival of the Harp Seals has meant the end of winter. Sam's father and grandfather before him hunted the seal. Their white fur, prized by the fur traders, always brings a high price.

A good hunter earns $500 to $2,300 for a 4 week hunt. After the hunt, Sam can buy supplies he needs for repairing his fishing equipment. Sam thinks the Harp Seals are a nuisance. They eat the fish which he catches.



Sam and other hunters move quietly across the ice to the seal rookery. Sam carries a heavy club. He and the others move into the herd. The seals try to run away, but Sam is too quick. He grabs a squealing baby Harp Seal from

its mother's side, swiftly gives it a hard blow to the head, killing it immediately. Using the heavy clu causes no damage to valuable fur. He tossess the dead baby aside and moves on into the frightened herd.

In a few hours the hunt is over. Sam skins the dead baby seals and takes furs back to the village where the women will help crape, wash, and bundle them for sale to the fur dealers. Sam has several hundred bundles of fur. It has been a good hunt!

GREEN PEACE

It is the second week in March. George Díaz and fifty other members of the Green Peace Foundation are on an ice floe in the Gulf of St. Lawrence. They hope to prevent the killing of baby Harp Seals. If they cannot stop the hunt, they hope to bring world-wide attention to this annual seal harvest.

Each late February and early March the female Harp Seal gives birth to a single white-coated pup. The pup only weighs fifteen (15) pounds at birth and has no layer of blubber to protect it against the arctic cold. The fur, not really white, but actually transparent, transmits the sun's rays allowing the pup's skin to absorb the heat energy. The heavy coat then acts as insulation, preventing escape of the heat.

The pup stays at its mother's side for about three weeks, taking in her rich milk. At the end of this time it has reached one hundred (100) pounds, and has begun to loose its snow white coat. It has also gained a protective layer of blubber. The mother then abandons it to fend for itself.

While polar bears are natural enemies of the baby harp seals, their chief enemies are the hunters who come each March when the pups are whelped to get their valuable furs. This annual kill is what George Díaz and Green Peace are protesting.

Last night ten members of the group went ashore, armed with spray cans of indelible red dye. They managed to spray several hundred baby seals, making their coats useless as fur, before the government police arrested them.

Today, hunters from three Norwegian and Canadian factory ships, as well as the local seal hunters, begin their annual slaughter of the baby Harp Seals. Green Peace brought ten (10) news photographers to record the kill for the media.

George thinks the method of killing the baby harp seals is brutal. He watches a hunter grab a squealing day old baby away from its mother's side. He sees the hunter swing his heavy club against the baby's head. He hears the huffing of the mothers, frantically searching for their dead babies. He sees one hunter skin a baby that is only stunned, not dead. He looks out over the blood reddened ice floe after the hunters leave. He feels sad at the day's end. Green Peace Foundation hopes to bring world-wide sentiment to their side and either stop this annual seal harvest or strictly limit the kill to the local seal hunters, forbidding hunting from the large factory ships. Otherwise the herd will soon become extinct.

Some people argue that the only reason George and Green Peace work to save the baby Harp Seals is because of their beauty. George replies that the main reason the seals are <u>hunted</u> is because of their beauty. He says that if they cannot be saved because of their beauty, no animal is safe, ever.

Additional Information

1. Polar bears prey upon baby Harp Seals. The babies' cries often give away their location.

2. Most of the baby seals are harvested not by local seal hunters but by large factory ships from Canada and Norway.

3. The 1979 quota, established by the Canadian government, was 150,000 pelts: 60,000 were taken by Canadian and Norwegian sealing interests, 30,000 were taken by local hunters Gulf of St. Lawrence area.

4. The fur is used to make women's coats. It is not particularly warm and is used chiefly as decoration.

5. Harp seals are not on the endangered species list.

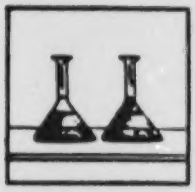
6. In 1972 the U.S. banned importation of products made from baby Harp seal fur.

7. Oil tankers will dump their cargo in case of a fire aboard ship which is in danger of reaching the oil.

Environmental Writer

Len Sung is writing an article for his local paper about the effect oil spills have on the environment. He is worried that the spills are endangering life in the ocean.

When oil tankers run aground, break up at sea, or run into each other, hundreds of thousands of gallons of crude oil are dumped into the sea. This oil kills birds, fish and other sea life and blackens the beaches with a gooey mess. One such accident happened in March, 1967, when the 120,000 ton tanker Torrey Canyon broke up off the Cornish coast. This spill killed an estimated 10,000 sea birds and untold numbers



of fish. Tankers sometimes dump their cargo before they reach port. This occurred near Wood's Hole, an oceanographer station in Massachusetts, spilling 75,000 gallons of fuel oil into the sea. It killed dozens of species of fish, shell fish, grasses, eels and worms. The practice of washing out the cargo holes with sea water after each unloading dumps at least 2,000,000 tons of oil a year into the ocean.

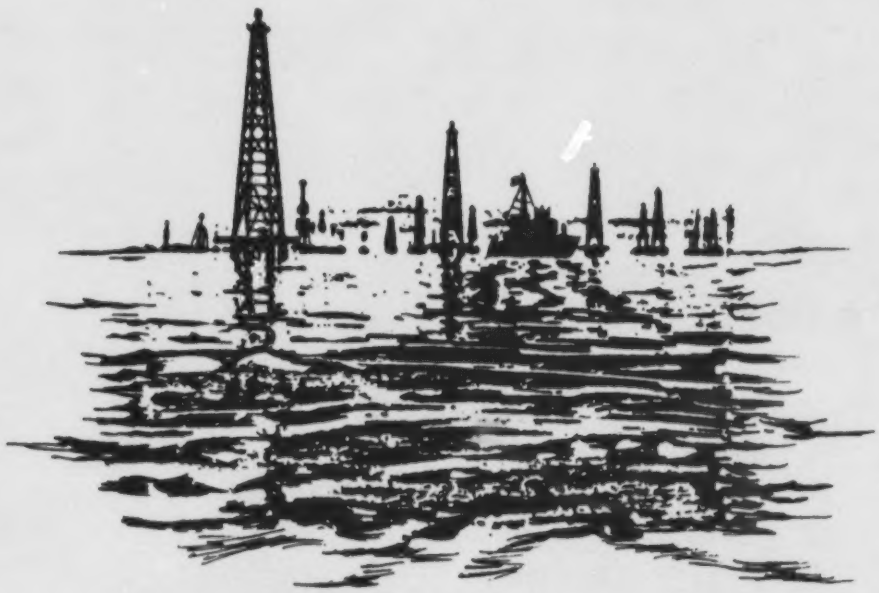
Pipeline spills cause ocean and beach pollution. One such pipeline break near Santa Barbara, California, wasted nearly 3 million gallons of crude oil, killed thousands of sea birds and fish and blackened the beaches for miles. An oil well blow out in the Gulf of Mexico off the Chiapas coast caused a 30 to 40 mile-wide oil slick. Gulf currents carried the slick north to the Texas coast where it contaminated the beaches for miles. Len asks himself who should be responsible for the oil spills? Can they be prevented? Who should be responsible for cleaning up the resulting mess? What do you think?

Pacífica Oil

Each year Pacífica Oil Company completes a government report. The report shows how much the company polluted the ocean due to oil spills of various kinds. Today, Gloria Black is completing the final report for the company.

Sea-going oil tankers carry more and more oil each year. Today six out of every ten commercial ocean-going vessels are oil tankers. Pacífica Oil Company has a fleet of 300 super tankers carrying crude oil from her production fields to refineries in the U. S. and other countries. The fleet's record has been good this year, Gloria thinks.

Tankers become involved in oil spills for many reasons. They run aground on shallow banks or reefs and spill oil into the sea. Storms



at sea can cause a tanker to break up, dumping thousands of gallons of crude oil. Sometimes ships run together. A ship occasionally dumps its cargo before it reaches port. Luckily, Pacífica's fleet had only one accident this year. One tanker ran aground during a storm.

After unloading their cargo, each tanker washes out its tanks by pumping in sea water, then pumping it out again. This cleans out the cargo tanks so they will be ready to receive their new supply from the field storage tanks.

Pipeline breaks, leaks from offshore drilling rigs and blowouts from oil wells waste valuable oil. One such break happened at one rig located off the California coast. Hundreds of gallons of crude oil gushed from the well before the leak was stopped.

All in all, Gloria's report is quite favorable: one ship ran aground in a storm, one oil pipeline broke, and tanks had to be cleaned. For a multi-national company the size of Pacifica Oil, it is a good record.

Exercise

I. Sam Tobias hunts baby Harp Seals because:

a. he is a bully
b. dealers pay a good price for their fur
c. he is a fisherman

II. George Díaz thinks it is wrong to hunt baby Harp Seals because:

a. they are cuddly
b. they will become extinct if hunting continues
c. he doesn't like the hunters

III. Gloria Black thinks Pacífica Oil has a good pollution record because:

a. the tankers are washed out and cleaned after each trip
b. only one tanker had an accident
c. it is a large company

IV. Len Sung is worried about oil spills polluting the ocean because:

a. oil spills waste oil
b. oil spills cause prices to rise
c. oil spills kill birds, fish and other sea animals.

V. Write your opinion:
(Choose only one from each pair)

A1. I think it is all right to kill baby Harp Seals because ...
A2. I think it is not all right to kill baby Harp Seals because ...
B1. I am not concerned about oil spills because...
B2. I am concerned about oil spills because ...

Key to Exercise

I. b

II. b

III. b

IV. c

V. Accept all logical answers. These are divergent questions

HOME and COMMUNITY

HOME: The students may survey the family pantry; they may find products which come from the sea, such as tuna fish, shellfish, or pet food, which is often made from fish or whale. Students may discuss with family members the harvesting of such products. The students may also discuss with the family the damage done to ocean life and beaches by oil spills. This may affect:

Tuna - Porpoise Relationship

Dredging oyster beds

Whaling industry

COMMUNITY: The students may visit a supermarket or fish market and list products from the sea.

The students may go to the beach and look for evidence of oil spills.

They may look in magazines such as National Geographic, or Smithsonian for articles related to environmental problems. (See Readers Guide to Periodical Literature.)

The students may research organizations such the Cousteau Society or the Green Peace Foundation.

EVALUATION

I. Choose one best ending for each statement

A. To alter an environment means

1. to leave it alone
2. to change it
3. to destroy it

B. Oil spills alter an environment by

1. wasting oil
2. killing birds, fish and other sea life
3. making oil prices go up

C. An oil tanker might dump fuel oil because

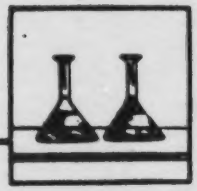
1. a fire broke out on the ship
2. the price offered for the oil was too low
3. the ship was overweight

D. Baby Harp Seals are killed

1. because their fur is very valuable
2. because they eat fish
3. because they are so plentiful

E. Green Peace Foundation wants to save the Harp Seals because

1. the way of killing them is brutal
2. their fur is not really needed to make coats
3. continued killing will cause them to become extinct



EVALUATION

II. You are a baby Harp Seal hunter. List two reasons you hunt them every spring.

1. _____

2. _____

III. You are a member of Green Peace Foundation. List two reasons you want the seal hunt stopped or limited to just the local hunters.

1. _____

2. _____

IV. You live near a beach. List two ways an offshore oil spill may affect you.

1. _____

2. _____

V. Who do you think should clean up the mess from an oil spill,

- the oil company?
- the government?
- local volunteers?

Explain your answer.

_____

_____

_____

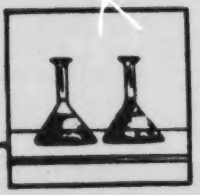
_____

_____

_____

_____

_____



EVALUATION

Evaluation Key

I. A. 2

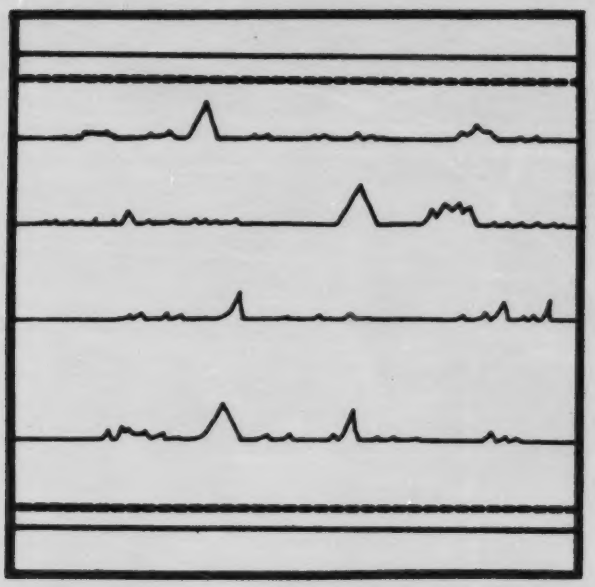
B. 2

C. 1

D. 1 (accept 2 if student can justify answer)

E. 3 (accept 1,2 if student can justifiy answer)

Numbers II, III, IV, and V are subjective items. Discuss with students to be sure they can justify whatever answer they give.



COMPONENT I
Section Three

Section Three
Ecological Factors in Marine Science

Learning Objective

Using a description of an ocean-based ecosystem, the student will demonstrate an understanding of the principles of ecology by listing the factors which function as controls on the size of populations with a 70% accuracy.

Key Words

- ecology
- saturate
- evaporate
- optimum
- chlorophyll
- plankton
- kelp

Domains and Levels

Cognitive : Knowledge, Comprehension, Application, Analysis

Affective : Receiving, Responding

Materials

- copies of ecological factors in an eco-system
- Alan Miller, Marine Ecologist
- other factors in an eco-system
- worksheet

IMPLEMENTATION GUIDELINES

Time: 1 or 2 Classes

STEP I - This lesson is designed to increase the student's awareness of the ecological factors which control the size of population in an environment. A list of the factors is given. Each factor is discussed.

STEP II - The lesson may be used as an individual lesson, a small group lesson or as a class lesson. Using the appropriate charts, posters and transparencies enhances the lessons.

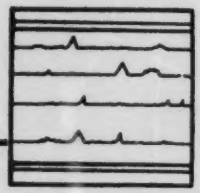
STEP III - Reading and discussion may be one day's lesson, or the teacher may use two days to cover the material depending on the reading level of the group.

STEP IV - The worksheet may be answered individually; then the students may exchange papers and check their answers.

STEP V - Evaluation

STEP VI - The Home and Community activity may be assigned if there is sufficient time.

STUDENT ACTIVITY MATERIAL



Introduction

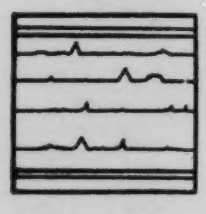
We live on a planet where the natural resources, both mineral and organic, are rapidly running out. This has made the ocean very important. Marine Science is a field concerned with finding and using the resources of the sea. Obtaining these resources results in altering or destroying an existing environment.

Food supplies are depleted. Water and the air are polluted. The amount of sunlight reaching the planet's surface changes. Temperature changes occur. Predators are destroyed and this causes overpopulation of some species. Territories are altered or changed when Man moves into an environment.

How does Man change an environment?

What are reasons <u>for</u> Man's changing an environment?

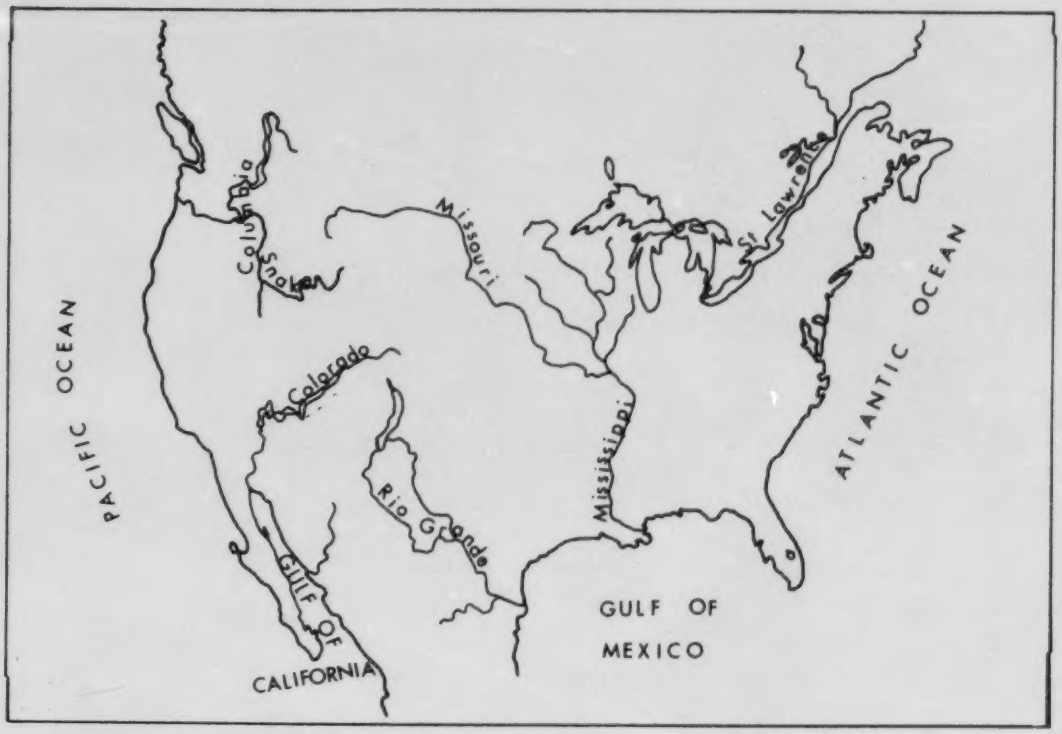
What are reasons <u>against</u> Man's changing an environment?



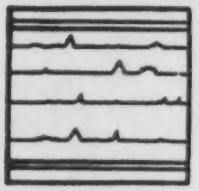
Alan Miller, Marine Ecologist

Anderson Middle School has invited Dr. Alan Miller to give a talk on marine ecology. Dr. Miller studies environmental conditions of the oceans of the world. He investigates changes that can affect the delicate life-chain balance. The science students of Anderson feel proud that Dr. Miller accepted their invitation. He is a famous man, and his time is valuable. He has brought two assistants with him.

Dr. Miller begins his talk by showing the students a picture of a major river system. He says:



"This map shows the major river system of the Continental United States. The five Great Lakes empty into the St. Lawrence River, and eventually into the Atlantic Ocean. Look at the Snake River. The Snake River joins the Columbia River. Look at the Colorado River. It empties into the Gulf of California, a part of the Pacific Ocean. Can you see the Río Grande? Where is its mouth? A heavy rain falls in northern Montana. The water runs off into the Missouri River. Into what river does this flow next? What ocean will it eventually reach?"



Dr. Miller gives the science students plenty of time to ask questions about a river system. Then he continues his talk:

"Earth's water supply continually renews itself. Water evaporates from the ocean. Droplets of water vapor condense. These condensation particles eventually form clouds. When a cloud becomes saturated with water particles, rain falls. The surface water runs off into rivers or soaks into the water table. Eventually the water reaches the ocean and the cycle begins all over."

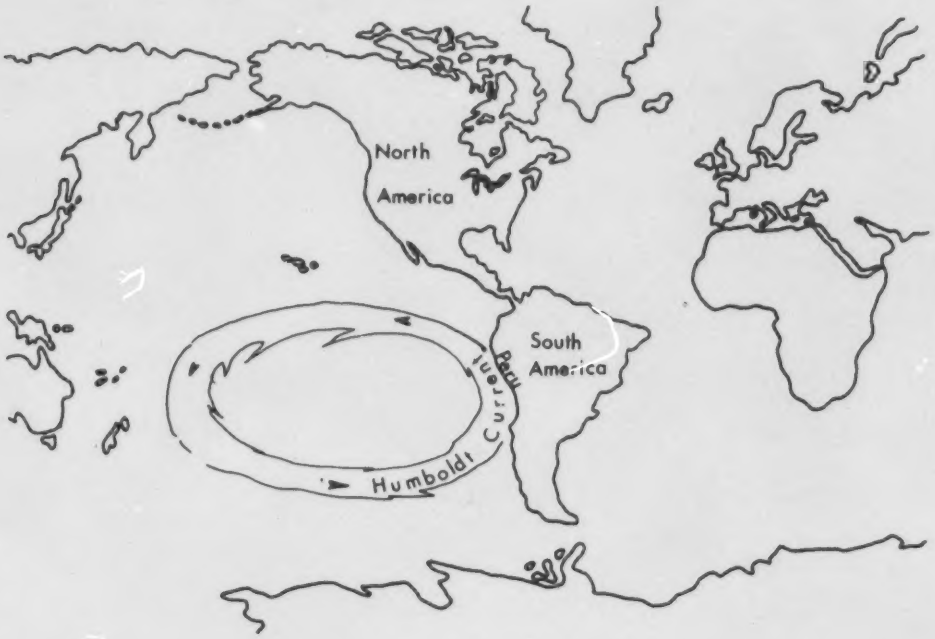
Dr. Miller then introduces the students to his assistant, Alfredo Casanova. Alfredo tells the students he is an Aquatic Biologist who specializes in ecology, like Dr. Miller. He says:

"Temperature acts as a third control on populations. Each species works best at an optimum (best) temperature. Water-dwelling species can withstand less temperature variation than can land based species. Any sudden change in their temperature environment can cause disastrous results.

"The western coast of Peru, in South America, is one of the driest regions in the world. The Humbolt Current, a cold water current moves up from the south. Dry winds blow from the land seaward, causing the desert condition.

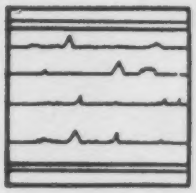
In 1925 something happened to cause the Humbolt Current to move farther offshore. Warm seas from the North moved in, warming the temperature of the sea 5° C."

"The plankton (microscopic animals and plants) which lived in the seas off western Perú died because of the 5° C rise in temperature. Small fish which ate the plankton died from lack of food. Large fish also



died because of lack of food. A shift in the wind, from seaward to landward, caused torrential rains to fall. The rains wiped out guano beds, gullied the dry desert, destroyed the farmers' crops, washed out roads, destroyed countless species of plants, and killed thousands of animals and people."

"So you can see", concludes Alfredo,"what a change can do to the eco-system. The current went back to normal after a while, but it was years before the land returned to its normal state."

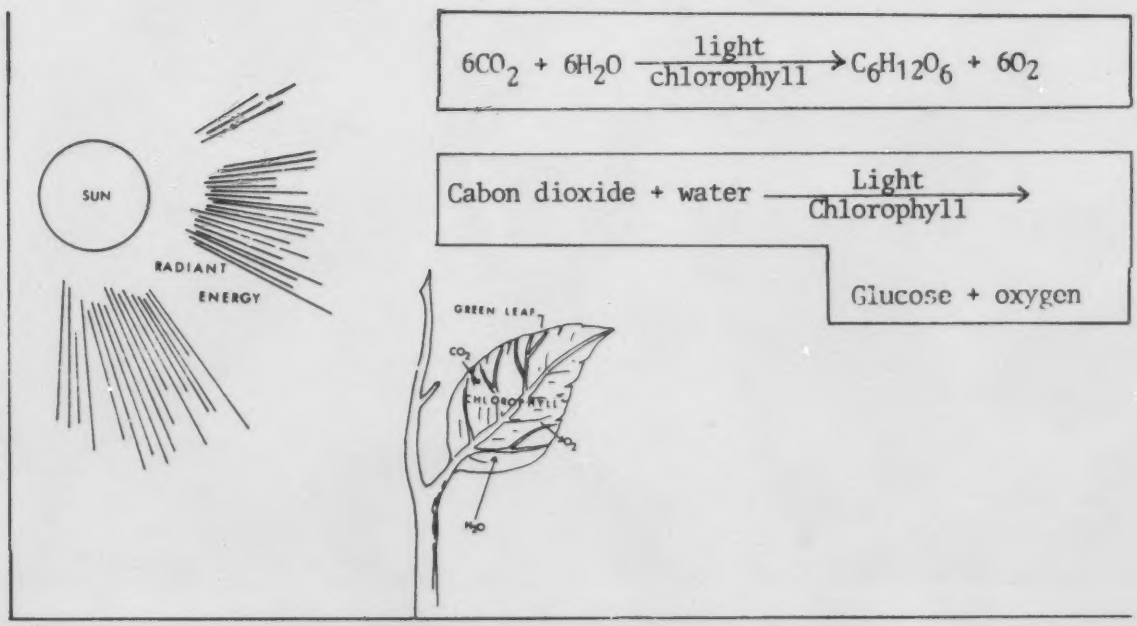


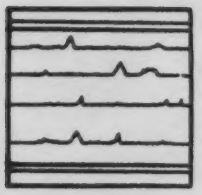
Other Factors in an Eco-System

After Dr. Miller and Alfredo finish their talk, they answer the students' questions about the first three factors in an eco-system. When all the students' questions are answered, Dr. Miller introduces Tere Garrison, his other assistant. She explains to the class that she is an Ichthyologist, a big word that means Tere is a scientist who studies fish. Tere explains to the students:

"All life on Earth depends on the sun. Green plants, the beginning of all food chains, use the sun's light energy to change carbon dioxide and water to sugar and oxygen. This process, PHOTOSYNTHESIS, forms the basis for all good energy and is a prime source of free oxygen in the atmosphere."

Tere projects a diagram of the process of photosynthesis.





All the science students recognize the formula. They have studied it in class. Tere continues:

"Green plants, the food PRODUCERS, grow on the average only on the top 35 meters of the ocean's surface. Water reflects most of the sunlight which strikes it, absorbing bright light only to a depth an average of 35 meters. Below that, the water becomes darker and darker.

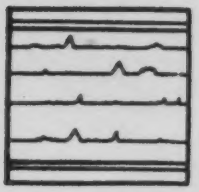
"Only very simple plants, algae, grow in the 35 meter deep region. But they supply food for all sea dwelling life, and much land based life. These plants, also produce 80% of all the free oxygen in Earth's atmosphere.

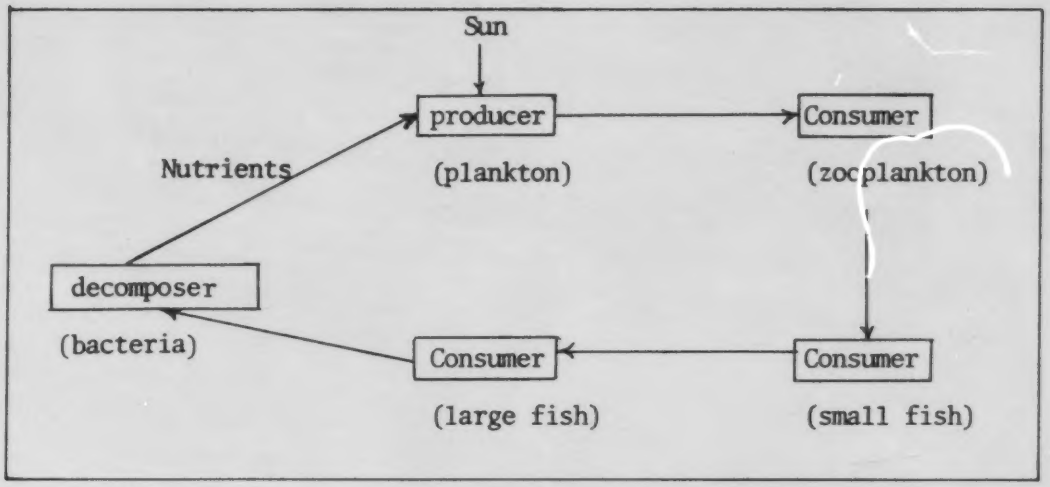
"There are green plants that contain the chlorophyll. Chlorophyll is necessary to carry out photosynthesis. These plants grow in many forms. Some, microscopic in size, called plankton provide food for microscopic animals, called zooplankton. Plankton and zooplankton both, surprisingly, provide food for the largest of all mammals, the whales.

"Other algae, growing in disorganized groups of cells, called sea weed provide food for larger forms of sea life: small fish, snails, crabs, etc. Kelp, a large brown, red or yellow algae, often grows to a length of 10 to 20 mm. Kelp is rich in food nutrients, and is used commercially as fertilizer, ice cream stabilizer and food for humans. Kelp may be purchased at many health food stores."

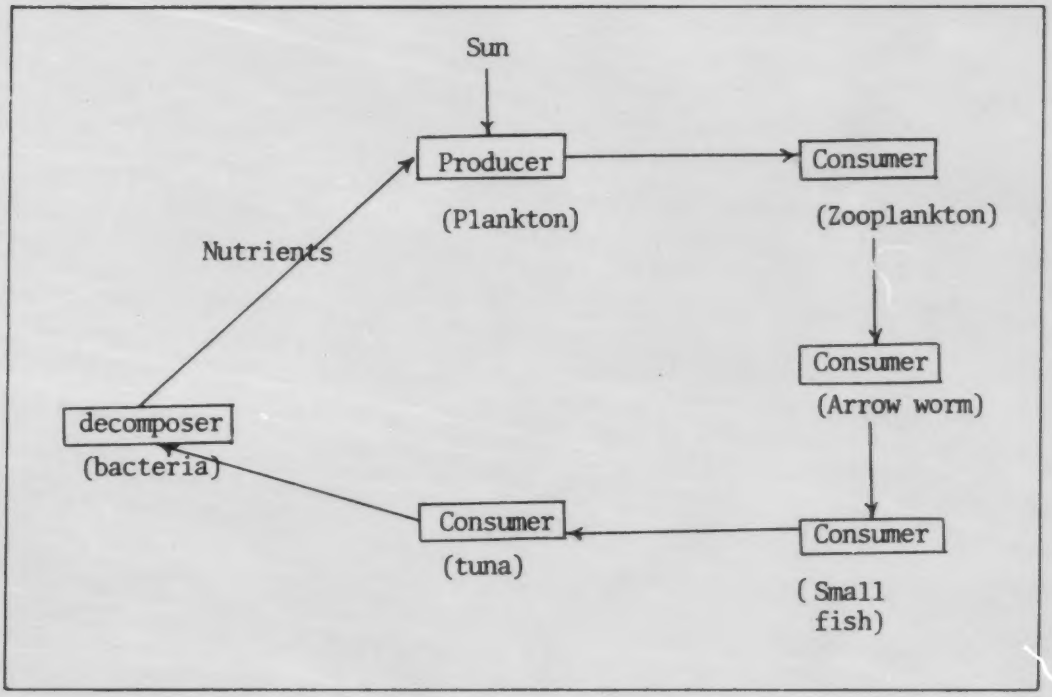
"I can imagine what it tastes like," exclaims Pepe. Tere concludes her talk:

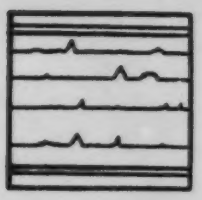
"Bacteria or dead matter return nutrients to the sea. Algae in turn use these nutrients in photosynthesis, and the cycle repeats."





Nutrient Cycles





Worksheet

After the three scientists finished the presentation, they asked the science students these questions. See if you can answer them.

1. What are the five ecological factors mentioned in the story?
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
2. Name the gas in Earth's atmosphere that is necessary for all living organisms.

   _____
3. List two ways water temperature may be changed.
   a. _____
   b. _____

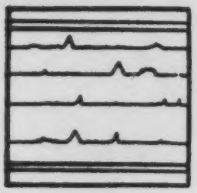
   _____
4. Name the source for all life on Earth.

   _____
5. What is photosynthesis?

   _____

   _____

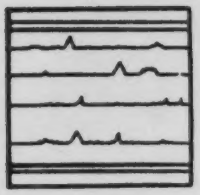
   _____



Answer Key

After the three scientists finished the presentation they asked the science students these questions. See if you can answer them.

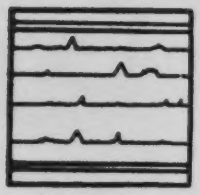
1. What are the five ecological factors mentioned in the story?
   a. water
   b. oxygen
   c. temperature
   d. sunlight
   e. food
2. Name the gas in Earth's atmosphere that is necessary for all living organisms.
   oxygen
3. List two ways water temperature may be changed.
   a. ocean currents may change
   b. factories may release hot water or pollute the streams and rivers
4. Name the source for all life on Earth.
   the sun
5. What is photosynthesis?
   The process by which green plants make food (sugar)



Exercise

Match the items in List 1 with the items in List 2. Write the correct letter from list 2 in the blank.

List 1	List 2
_____ 1. gas necessary for all living organisms	a. Green peas
_____ 2. kills birds, fish and other sea life	B. water
_____ 3. killed for their valuable fur	c. food
_____ 4. wants to restrict killing of baby Harp Seals	d. sun
_____ 5. process by which a green plant makes food	e. oxygen
_____ 6. source of all life on Earth	f. Baby Harp Seals
_____ 7. product of photosynthesis	g. photosynthesis
_____ 8. makes up most of tissues of all living thing	h. oil spills



Answer Key to Exercise

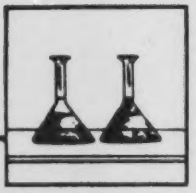
1. e oxygen
2. h oil spills
3. f Baby Harp Seals
4. a Green Peace
5. g photosynthesis
6. d sun
7. c food
8. b water

HOME and COMMUNITY

HOME: The student may speak with any member of his or her extended family who works in Marine Science. A report of the activities of the job may be written and shared with the class.

COMMUNITY: The student may do one or more of the following activities.

1) look for evidence of water pollution in the community
2) research the local water supply. He or she may find out:
    a) where water comes from
    b) how water is made safe to drink
    c) how water is disposed of



EVALUATION

I. Match the examples given in List 1 with the ecological factors in List 2. The factors in List 2 will be used more than once.

List 1		List 2
_____	1. best temperature for a species to function.	a. water
_____	2. nearly 75% of Earth's surface	b. oxygen
_____	3. gas needed by all living things	c. optimum temperature
_____	4. source of life on Earth	d. sunlight
_____	5. matter which makes up most of tissues of all living things	e. food
_____	6. green plants use water and carbon dioxide to make this	
_____	7. energy source for photosynthesis	
_____	8. make up about 21% Earth's atmosphere	
_____	9. changed by dumping hot water from nuclear power plants	
_____	10. consumed by animals	

EVALUATION

Evaluation Key

1. c - optimum temperature
2. a - water
3. b - oxygen
4. d - sunlight
5. a - water
6. e - food
7. d - sunlight
8. b - oxygen
9. c - optimum temperature
10. e - food

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Component 2

Section One

Section Two

Section Three

HOW'S YOUR HEALTH?

OVERVIEW

This component links the scientific principles of cellular structure and function to the world of work. Careers in the Health Cluster are related to nutrition and maintenance of good health. Section One emphasizes the value of transferring skills from one job to another while reviewing cells and their structure. Section Two tells the story of Oscar, a white blood cell, and the results of improper nutrition. Section Three explores selected jobs in health and their relationship to materials that cells require to maintain life.

GOALS

OBSERVING:	Students will identify the functions and characteristics of cells through a study of careers in the field of health.
INFERRING:	Students will reach conclusions about nutrition and the effect this has on cellular and body health.
PREDICTING:	Students will predict results of poor nutrition, relating it to selected careers in health.

LEARNING SECTIONS

SECTION 1: Cells: Functions and Characteristics

SECTION 2: Oscar and Lupe

SECTION 3: Coke and Candy Aren't Just Dandy!

COMPONENT II
Section One

Section One

Cells: Functions and Characteristics

Learning Objective

Given a case study concerning the transfer of skills in the field of health, the student will identify the characteristics and functions of cells with 70% accuracy on the evaluation.

Key Words

- cytoplasm
- membrane
- nutrients
- oxygen
- exercise
- gene
- chromosomes
- nucleus
- reproduction
- energy

Domains and Levels

Cognitive: Knowledge, Comprehension

Affective: Receiving, Responding

Materials

- sufficient quantities of the activity and evaluation sheets for all students.

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - The teacher should introduce the activity by discussing the vocabulary words and by reviewing the relationship between cellular health and bodily health.

STEP II - The teacher should read the story aloud or have a student read the story to the whole class.

STEP III - The questions at the end of the story are designed to start a discussion. Some other questions for the discussion might be:

1. What kind of foods should we eat to be sure we are getting a balanced diet?

2. Why is exercise good for our cells and for our bodies?

3. Besides eating good food and getting exercise, what other things can we do to keep us healthy longer?

    a) Don't smoke
    b) Try to avoid polluted water, air, etc.
    c) Stay away from radioactivity, etc.

STEP IV - The students should then work individually on the activity sheet. They may exchange papers to check the answers. The teacher may assign the special project to reinforce students' grasp of basic vocabulary.

STEP V - Evaluation

STEP VI - The Home and Community section is optional and should be completed if there is time.

STUDENT ACTIVITY MATERIAL

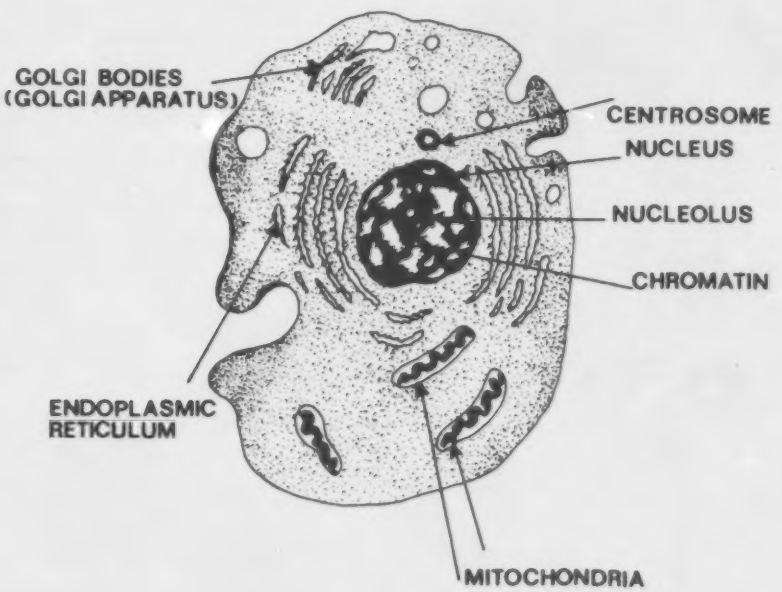
John Grimes

John Grimes became a registered nurse because he wanted to help sick people get well. He knew that he could expect good pay and that he could always find a job. Nurses are always needed, so he could make his home anywhere in the land and still have a good job.

John also liked the detective-like part of being a nurse. The human body is made up of lots of cells. When cells get what they need to do what they are supposed to do, a person is healthy. In school, John had learned that most of our cells have the same characteristics. Each cell has a cell membrane which separates it from the outside and from other cells. All cells except blood cells have a nucleus which controls their activities. Inside the nucleus are tiny twisting threads called chromosomes which carry the hereditary elements or genes. The part that surrounds the nucleus is called the cytoplasm. Cells need each of these things to do their job.

Cells are supposed to do two main things. They make other cells,

or reproduce when old cells die and when the body needs to grow. They make energy so that the person can move and think. In order to do what they are supposed to do, cells need oxygen, which they get from the air we breathe, and nutrients, which they get from the food we eat. When cells do not get what they need, they don't do what they are supposed to do. Then a person gets sick. Once you know how cells work and what they need, trying to find out why a person is sick is like trying to solve a mystery. John has always enjoyed helping doctors find out what has gone wrong in a person's body. This is what a cell looks like.



For ten years John has been helping doctors find out why people are sick and helping sick people get well. Lately, John has not been so happy with his job. He has become more and more upset because many people who are sick do not need to be sick at all. If people understood their bodies a little better

they would be fine. John has seen that most people feel that getting sick is just something that happens. They think that they can't help it. People think that nurses and doctors are the ones who should keep them healthy. John knows this is not true. He knows that good health is something that each of us can work toward by paying attention to how we live. John has decided that what he really wants to do is to help people stay well. He wants to teach them more about the cells in their bodies and tell them that the way they live can help those cells work better.

If the cells in the body are healthy then the body will be healthy. We can keep the cells healthy by making sure we get plenty of exercise and good food. Exercise makes healthy cells because it makes our blood flow faster. Since blood carries oxygen to cells, the faster the the blood flows, the more oxygen the cells get. Good food is important. It provides the things that cells need to do the job of making energy and making more cells. Some food doesn't help the cells, though. Too much starch and sugar are bad because they fool us into thinking we are not hungry, when really our cells have not gotten what they need!

John is lucky. There are many different jobs that he could get. The three jobs he decides to explore are health education officer, public health educator, and public health nurse. All of these jobs teach people how to prevent sickness. The difference in the jobs is how and whom the person teaches. The public health nurse goes into people's homes and teaches families and single persons. Public health educators work with larger groups. They write about how to stay well, and they make sure that what has been written is read by many people. The health education officer works with even larger groups. He or she makes sure that knowledge about good health can be learned by anyone in the whole state by teaching people who will go out and teach other people.

John has a hard choice to make, but he is very excited about changing jobs. His training as a nurse and his interest in teaching about good health will be a big help in making the change. If you were John which job would you choose? Why?

ACTIVITY SHEET

Match the words in the list to the correct definition by writing the letter in the space.

a. membrane
b. nucleus
c. cytoplasm
d. chromosomes
e. gene
f. oxygen
g. nutrients
h. reproduction
i. energy
j. exercise

_____ 1. Tiny, twisting threads inside the nucleus.

_____ 2. An element that carries hereditary factors.

_____ 3. Makes the blood flow faster, bringing more oxygen to the cells.

_____ 4. Separates the cell from other cells.

_____ 5. Provided by the food we eat.

_____ 6. What enables us to move and think.

_____ 7. Controls the activities of cells.

_____ 8. Needed to replace dying cells and for growth.

_____ 9. Surrounds the nucleus.

_____ 10. Brought to the cells by blood from the lungs.

ANSWER KEY

1. d
2. e
3. j
4. a
5. g
6. i
7. b
8. h
9. c
10. f

SPECIAL PROJECT

Find ten words from the story in the word-find puzzle.

O	E	P	J	R	T	Z	R	G	A	V	B	P	M	O	Z	M
P	S	H	Q	L	K	M	N	O	E	N	E	R	G	Y	S	E
S	I	A	M	S	U	E	L	C	U	N	A	B	U	A	T	P
D	C	G	U	T	Z	M	Z	D	H	K	E	K	L	P	E	T
T	R	O	D	F	N	B	P	J	P	E	B	P	C	A	I	Z
Z	E	C	O	C	H	R	O	M	O	S	O	M	E	S	R	V
O	X	Y	G	E	N	A	L	O	U	T	K	A	O	R	T	D
N	E	T	Z	W	S	N	R	Q	Y	L	C	I	S	A	U	J
W	I	E	E	U	V	E	I	C	T	L	B	J	T	R	N	K
R	E	P	R	O	D	U	C	T	I	O	N	N	D	B	A	N

SPECIAL PROJECT - ANSWER

O	E	P	J	R	T	Z	R	G	A	V	B	P	M	O	Z	M
P	S	H	Q	L	K	M	N	O	E	N	E	R	G	Y	S	E
S	I	A	M	S	U	E	L	C	U	N	A	B	U	A	T	P
D	C	G	U	T	Z	M	Z	D	H	K	E	K	L	P	E	T
T	R	O	D	F	N	B	P	J	P	E	B	P	C	A	I	Z
Z	E	C	O	C	H	R	O	M	O	S	O	M	E	S	R	V
O	X	Y	G	E	N	A	L	O	U	T	K	A	O	R	T	D
N	E	T	Z	W	S	N	R	Q	Y	L	C	I	S	A	U	J
W	I	E	E	U	V	E	I	C	T	L	B	J	T	R	N	K
R	E	P	R	O	D	U	C	T	I	O	N	N	D	B	A	N

exercise
oxygen
phagocyte
chromosomes
membrane
cytoplasm
gene
nutrients
energy
reproduction

HOME and COMMUNITY

The student should discuss ways of staying healthy with his or her family. Together, the student and his/her family should try to determine how they could change their lifestyles both individually and as a family to ensure greater health for each family member. The student may list five ideas the family has come up with to improve health and share the list with the class.

EVALUATION

I. Answer the following from your reading:

1. Four careers were mentioned in the narrative. Name two and describe what that job requires you to do.

   a. _____

   _____

   b. _____

   _____

2. Cells do two important things. What are they?

   a. _____

   _____

   b. _____

   _____

3. Name two important things we can do to keep healthy.

   a. _____

   b. _____

4. Why is too much starch and sugar bad for the cells?

   _____

   _____

EVALUATION .

5. Describe a cell. Name as many parts as you can. _____

_____

_____

_____

_____

II. Fill in the blanks with the correct word.

1. A _____ separates the inside from the outside of the cell.
2. A _____ is an element which carries hereditary factors.
3. _____ is brought to the cells by blood from the lungs.
4. The part of the cell that surrounds the nucleus is called _____.
5. _____ makes the blood flow faster and brings oxygen to the cells.

EVALUATION

ANSWER KEY

I. 1. Accept any of the following:

a. Registered Nurse - Cares for sick people.

b. Health Education Officer - Teaches large groups who will train other peple about health.

c. Public Health Educator - Writes about how to stay healthy.

d. Public Health Nurse - Goes to people's homes and teaches how to prevent illness.

2. a. Reproduce

b. Give energy

3. a. Eat correctly

b. Exercise

4. It makes us think we aren't hungry, depriving cells of valuable nutrients.

5. A cell has a membrane separating the inside from the outside and from other cells. It has a nucleus (except blood cells). The nucleus has chromosomes which in turn carry genes.

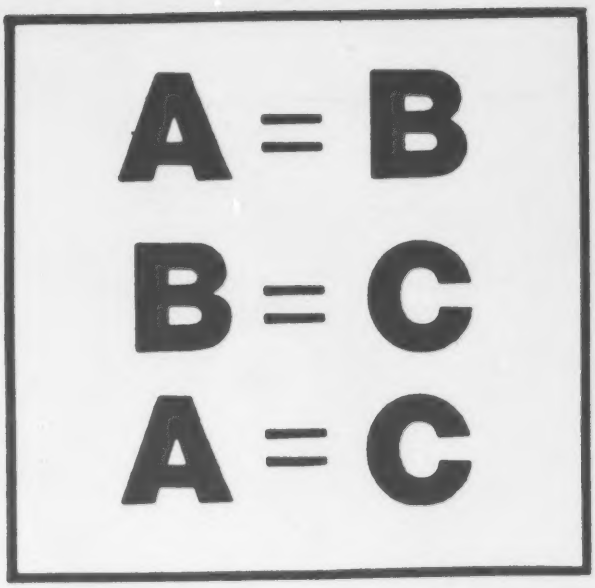
II. 1. membrane

2. gene

3. oxygen

4. cytoplasm

5. exercise



COMPONENT II
Section Two

Section Two
Oscar and Lupe

Learning Objective

Given a narrative concerning the importance of diet in maintaining good health, the students will write and perform a skit to achieve a successful solution to the problem. Completion of the skit according to the teacher's criteria.

Key Words

- phagocyte
- lymphoid cells
- antibodies
- vitamins
- minerals
- handicapped
- nutrients

Domains and Levels

Cognitive: Knowledge, Comprehension, Application, Analysis, Synthesis

Affective: Receiving, Responding, Valuing

Materials

- sufficient copies of the activity and evaluation sheets for each student.

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - The teacher should introduce the activity by discussing the characteristics and functions of cells and the role of proteins, fats and carbohydrates in the healthy maintenance of cell life.

STEP II - The teacher should then have the students read the narrative silently to themselves, after which one or two students should be chosen to read the story aloud to the class. (If time is limited, the teacher may choose to read the story aloud.)

STEP III - The teacher should divide the class into groups of 6-7 students and have each group write and perform a short skit which presents a solution to Oscar's problem.

STEP IV - After the skits have been performed the teacher should lead a discussion about the possible solutions chosen by the students. Some other possible questions for the discussions might be:

a) What other people, outside of those mentioned, might first notice the problem?

b) If you were to try to live almost entirely on sweet foods and cokes, what kind of things would happen to you?

c) If you ate some meat and vegetables but also quite a few cokes and cakes, what kind of things might happen to you?

d) How does eating right help prevent sickness?

STEP V - The Home and Community activity is optional, to be completed if time allows.

Oscar, the Protector

Hi! My name is Oscar, and I am a phagocyte. A phagocyte is to the human body what a policeman is to a city. A policeman protects people from harm. I am simply a cell that protects other cells from harm. Foreign cells like those found in colds, flu and more serious diseases like polio are always attacking the body. I work along with my friends, the lymphoid cells, to get rid of these no-good cells. When some of these strange cells get into the body, my friends, the lymphoid cells, make special protein molecules called antibodies which attach themselves to the strange cells. When I see a cell that has an antibody on it, I

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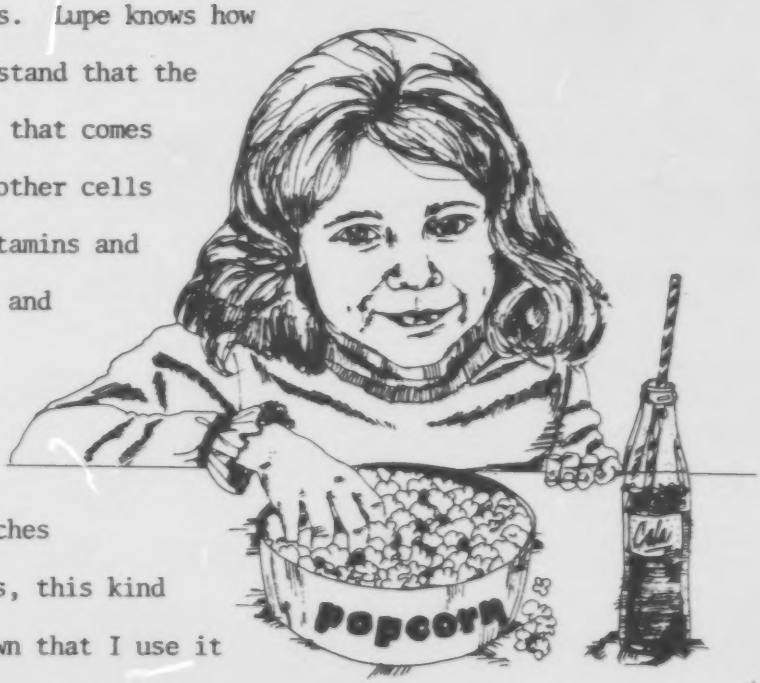
A = B
B = C
A = C

know that it's my job to get rid of this cell. I simply eat it whole! When you cut your finger or scrape your knee and dirt gets inside you, I don't even need an antibody to tell me what to do. I attack dirt right away.

Usually I do my job well. Protecting the body is fun, and I enjoy it. But lately I have not been feeling well. I have no energy, and I am tired all of the time because I am not getting the right kind of nutrients. I live in the body of a girl named Lupe Alvarado. Lupe was treating me quite well before, but a month ago her mother got real sick and had to go to the hospital. Lupe's father is dead, and she doesn't have any brothers or sisters. Since her mother has been in the hospital, Lupe has eaten only cokes, pop-corn, cakes, doughnuts and other sweet things. Lupe knows how to cook, but she doesn't understand that the cells in her body need protein that comes from meat in order to replace other cells and to aid growth. We need vitamins and minerals that come from fruits and vegetables in order to help us fight sickness. Although the other cells and I can get energy from the sugar and starches that are in doughnuts and cokes, this kind of sugar is so easy to break down that I use it up too fast. The sugar in fruits is much better because it breaks down more slowly so it lasts longer. The starches that are



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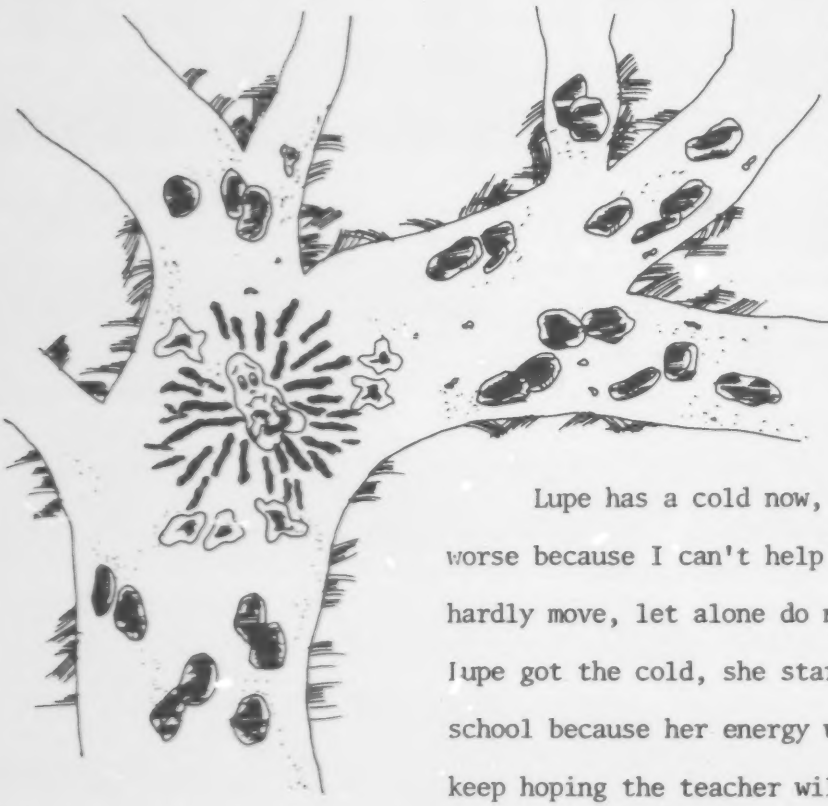
in most cakes and doughnuts do not help me much because the white flour that most cakes and doughnuts are made of does not have all of the vitamins and minerals that whole wheat flour does. I need these vitamins and minerals to do my work. When Lupe eats pop-corn and doughnuts, she doesn't want anything else. But the other cells and I are still hungry. In fact, we are starving!

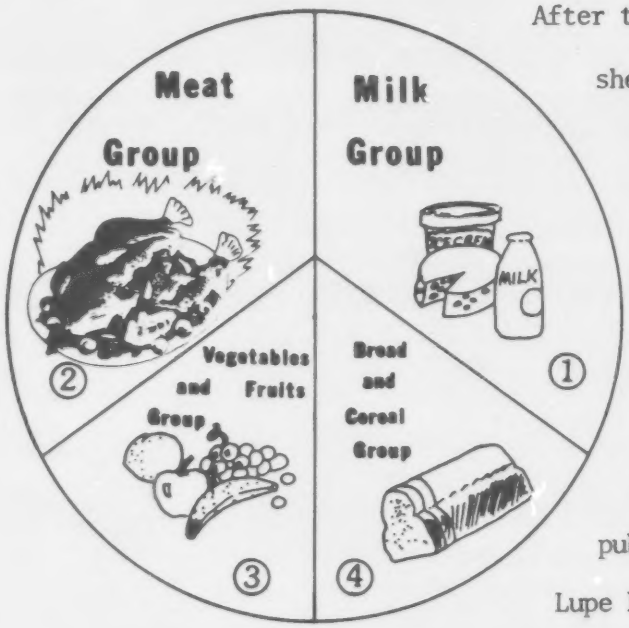


Lupe has a cold now, and it's getting worse because I can't help her very much. I can hardly move, let alone do my work. Even before Lupe got the cold, she started doing badly in school because her energy wasn't lasting. I keep hoping the teacher will see that there is something very wrong with Lupe. If the teacher would tell the school nurse, things might start looking up for both me and Lupe.

You see, it's the school nurse's job to make sure that students who are too sick to be in school are sent home and taken care of. It is also the job of the school nurse to try to help school children and their families with health problems that cannot be solved at home. If the school nurse tried to

A = B
B = C
A = C

send Lupe home, she would find out that Lupe's mother wasn't home but in the hospital. Once she found out that Lupe was home alone, she might begin asking her what she ate every day and find out she had no one to help her choose better food.

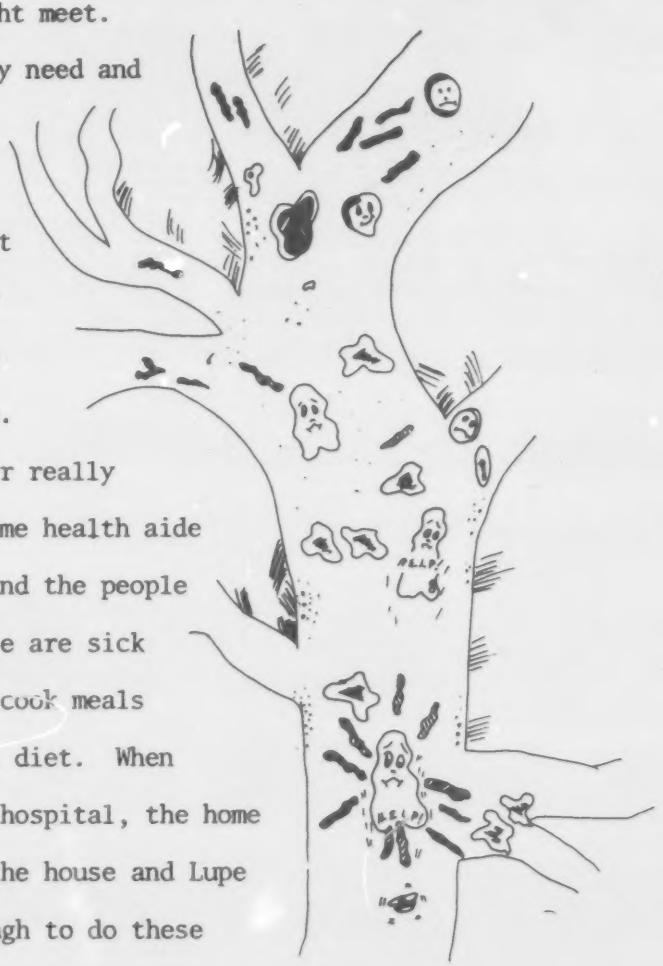


BASIC FOOD GROUPS

After the school nurse found all this out she could call in a public health nurse who visits homes to help people with health problems. The public health nurse would help Lupe choose better foods for herself and would teach her why it was important for her to eat right all the time. The public health nurse would also teach Lupe how important it would be for her mother to eat the right kinds of food when she comes home from the hospital. When a person has been sick, his or her body needs extra energy and extra vitamins and minerals. The phagocytes like me can keep busy eating up all the stuff that made them sick. Sick people need extra protein too, so that cells that died during the illness can be replaced.

The public health nurse would probably consult a therapeutic dietician. A dietician could help Lupe work out a diet that had foods that she liked and that were also good for her. This special diet would help cells like me

to feel better fast. Then we could get rid of the cold germs and protect Lupe from any other germs she might meet. When cells don't get the food they need and are weak, it is much easier for germs to invade them. When I don't get the food I need, I can't help them much. It can be a very dangerous situation, depending on what germs happen to be out there.



The person Lupe and her mother really need is a home health aide. A home health aide takes over the care of the home and the people in it when the adults in the house are sick or handicapped. She or he would cook meals for Lupe according to her special diet. When Lupe's mother came home from the hospital, the home health aide would care for her, the house and Lupe until Lupe's mother was well enough to do these things herself.

There are so many people who can help. I hope someone does something soon because I can't hold out much longer. Here come another bunch of germs! They are too many for me. Oh no! I'm going down! HE E E L P!

HOME and COMMUNITY

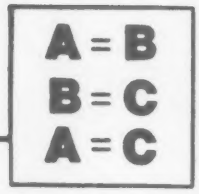
The student should ask his or her parents to help prepare a complete list of all food the student has eaten in one day. Look on the package or can to see how much sugar each food contains. The amount of sugar in proportion to the rest of the ingredients is shown by the place occupied on the list. If there is more sugar in the food than any other ingredient, the word "sugar" will be the first word in the list. How many of the foods eaten contain lots of sugar? How many contain no sugar at all? With the family's help, the student should decide whether his or her diet contains too much sugar and how he or she can cut down in the future.

A = B
B = C
A = C

EVALUATION

Inferring Results

Poor Oscar! Can you help him? Write a happy ending to the story in the form of a play. Use some or all of the people mentioned in the story as possible helpers. What part will a healthy Oscar play in making Lupe feel well again?.



EVALUATION

ANSWER KEY

The following may be taken into consideration when evaluating the students' skits:

Originality

Use of career information

Cooperation among group members

COMPONENT II

Section Three

Section Three

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Coke and Candy Aren't Just Dandy!

Learning Objective

Given a working situation which focuses on health careers and nutrition, the students will review cellular functions, and answer a set of questions about the probable effects of poor nutrition with 80% accuracy on the evaluation.

Key Words

- nutrition
- cholesterol
- fructose
- glucose
- amino acids
- monosaturated fats
- polyunsaturated fats
- saturated fats
- protein
- vitamins
- minerals
- calcium
- iron
- copper
- molecule
- carbohydrates

Domains and Levels

Cognitive: Knowledge, Comprehension, Application

Affective: Receiving, Responding, Valuing

Materials

- sufficient copies of the activity and evaluation sheets for all students.

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IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - The teacher may begin the activity by asking questions such as:

Did you know there are people from well-to-do families who are starving to death?

Are most Americans overweight or underweight?

Are people eating more or less than ten years ago?

What does a diet of cokes, potato chips and candy have to do with good grades in school?

What did you have for breakfast this morning?

STEP II - The vocabulary words and their meanings may be reviewed.

STEP III - The teacher may mention the fact that some special careers help people eat better:

Dietician - (D.O.T. 077-128) - Plans and directs food service in public and private institutions and establishments. Plans menus and diets providing food and nutrients for individuals and groups; may instruct individuals and groups in principles of nutrition or prepare educational materials on the nutritional value of food.

Research Nutritionist - (D.O.T. 077.081) - Studies and analyzes recent scientific discoveries in nutrition for application in current research, for development of tools for future research, and for interpretation to the public.

STEP IV - The students should read the activity individually and answer the questions on the evaluation sheet. They may refer to the narrative if necessary.

STEP V - The students should exchange papers and grade their neighbor's paper while the teacher leads a discussion about the answers to the questions.

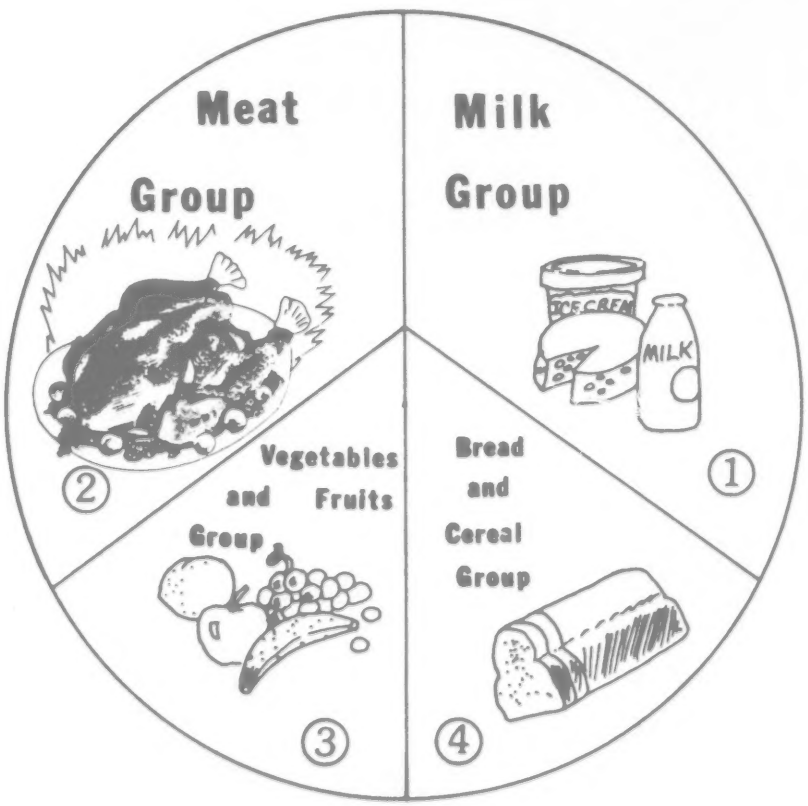
STEP VI - The Home and Community section is optional and can be completed if there is enough time.

STUDENT ACTIVITY MATERIAL

Diet and Nutrition

Manuel Goldburg is a dietitian, and his wife, Cissy, is a research nutritionist. Manuel and Cissy have quite an interesting marriage. They not only live together as husband and wife, but work together in the same field of nutrition.

Both Manuel and Cissy have strong feelings about the importance of nutrition in people's lives. Until recently most people, including doctors and scientists, thought that the only people who had real problems with nutrition were the very, very poor or those living in third world countries who never got enough to eat. Until the last few years,



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doctors did not have to take a class in nutrition in medical school. We all thought that poor nutrition only happened to other people. Now we know that poor nutrition is also a big problem here in the United States.

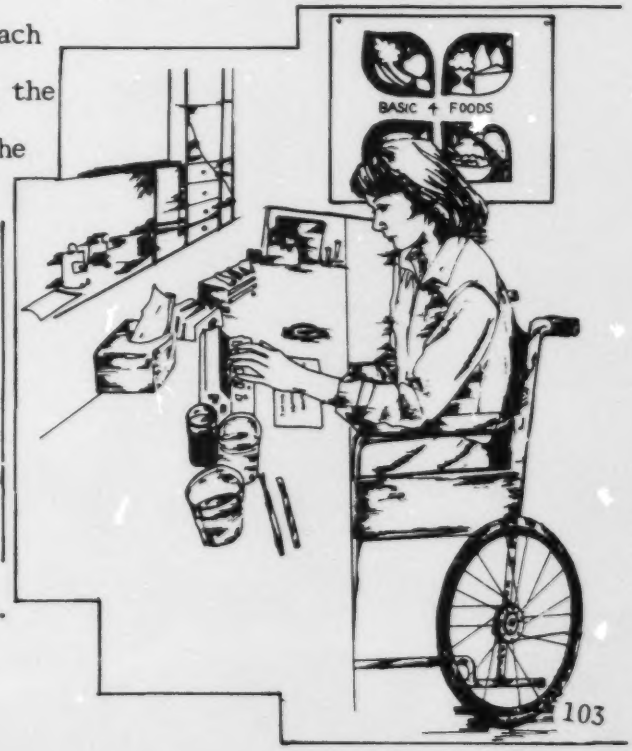
Most, but not all, of our problems here have to do with having too much to eat rather than too little. Eating too much and being overweight are two problems many people have. Being overweight makes it easier to get some diseases, like heart disease and diabetes. In this country, we also have many rich foods with lots of fat in them, like butter, steaks and french fries. Too much fat in the diet, especially fat that comes from animals, causes the blood vessels to become clogged with a substance called cholesterol. The cells in our bodies need oxygen and nutrients brought by the blood in order to live. The heart pumps blood to the cells. When the arteries are clogged with cholesterol, the heart has a hard time pumping blood to the cells. Sometimes it works so hard trying to get blood past the clogged arteries that it gives out completely. This is called a heart attack. Too much cholesterol has also been linked to breast cancer in women. Since the reason for this is not known, Cissy has chosen this problem as one of the problems she will study.

Manuel and Cissy work as a team not only at home but on the job. Cissy does research to find out why some things in food are bad for you and others are good. We still have much to learn about the many different kinds of things in food and how they affect health. Cissy likes

her job because there is so much that is not yet known. She likes being able to answer these important questions so that people can be healthier and live longer.

Manuel is a dietician. He plans food programs for places where people eat together, such as schools and hospitals. He takes the new discoveries that scientists have made and puts them to work in the everyday world. He makes sure the schools and hospitals for which he plans menus are serving the healthiest and most balanced meals possible. Both Manuel and Cissy often spend time talking to groups of people who want to know about good nutrition. They feel that people need to know about new discoveries. Both are also very concerned about food fads and TV ads that tell people to eat food that is not good for them.

Manuel and Cissy both try to teach people about nutrition by explaining the five different things the cells of the body need to keep the body healthy: carbohydrates, proteins, fats, vitamins and minerals. Carbohydrates come from sugars and starches found in fruit, bread and cereal. Cells get energy by breaking down sugar or glucose and making it into water and carbon dioxide.



It takes a great deal more

oxygen to hold a glucose molecule together than it does to hold water and carbon dioxide together. The energy that is left over is the energy we use to move and think. Starches and fruit sugars, or fructose, must be broken down into glucose before they can be used. Plain sugar is already broken down. This is why you feel a quick burst of energy from eating a candy bar. Fruit sugars and starches work better in the long run, however, because the energy they give lasts a long time. Energy from plain sugar is quickly used up. Fruit and whole grain flour are also better for you because they have more vitamins and minerals than plain sugar or baked goods made with white flour.

Minerals are needed to do special jobs in the body. Calcium is needed to make material for bones and teeth. Iron and copper help make red blood cells, for example. Vitamins help prevent certain diseases and help the body fight off diseases.

There are three kinds of fats found in the body: polyunsaturated fats, which are found in corn, fish and vegetables; saturated fats, which are found in olive oil and soybeans; saturated fats, which are found in meat and dairy products. All three kinds of fats will help you get fat it you eat too much of them, but they differ in other ways. Polyunsaturated fats help get rid of extra cholesterol in the body, while saturated fats build up cholesterol. Monosaturated fats have no effect either way.

Proteins build body tissues and help to make sure all body processes are working right. Proteins can also be burned to make energy if there are not enough starches. Proteins are made up of a number of different kinds of amino acids. Proteins that we get from eating meat and dairy products are called complete because they have all the amino acids we need. Proteins we get from plants are called incomplete because not all amino acids are in all plants. However, all amino acids are found in the plant world, so we can get all the amino acids we need from plants by simply eating certain kinds of plant foods together, like beans and rice, and peanut butter and bread.

By working together to find new facts about nutrition and to help people understand these facts and use them in their lives, Manuel and Cissy help people live happier, healthier lives. They say that when you know you are making other people happy it is easy to be happy yourself.

HOME and COMMUNITY

The student should ask his or her family to help classify 5 statements in TV or newspaper ads about food. The student should list statements found in three categories: (1) statements based on scientific study, (2) statements based on expert opinion, (3) statements based on neither. The statements and their classification may be shared with the class.

EVALUATION

After reading the story, answer the following questions:

1. Is it possible for you to have poor nutrition even though you live in the United States? Why or why not?

_____

_____

2. If your diet was almost always made up of steaks and french fries, what diseases might you get eventually?

_____

_____

3. How could you try tc prevent extra cholesterol in your body?

_____

_____

4. John ate a candy bar for breakfast, and Mullin ate whole wheat toast, a glass of milk and an orange. What might be the difference in the way they acted in school that day?

_____

_____

5. If Bobby was not getting enough calcium in his diet, what might happen to him?

_____

_____

EVALUATION

6. If Barbara tries to go on a diet by changing all the saturated fats she has eaten before for polyunsaturated fats, will she lose weight? Why or why not?

_____

_____

7. If Lázaro's mother made sure he got all the vitamins and minerals he needed, while Tina's mother paid no attention to what she ate, what might be the difference in their school attendance?

_____

_____

8. If you were a doctor who went to medical school 10 years ago, would you have taken a class in nutrition?

_____

_____

9. Do all foods that have proteins have all the amino acids the body needs?

_____

_____

10. Can a person who does not eat meat or dairy products have a healthy diet? Why or Why not?

_____

_____

EVALUATION

KEY

1. Is it possible for you to have poor nutrition even though you live in the United States? Why or why not?

Accept all logical answers.

2. If your diet was almost always made up of steaks and french fries, what diseases might you get eventually?

Heart disease and diabetes.

3. How could you try to prevent extra cholesterol in your body?

By not eating a lot of foods with animal fats in them.

4. John ate a candy bar for breakfast, and Mullin ate whole wheat toast, a glass of milk and an orange. What might be the difference in the way they acted in school that day?

John would be tired later on in the morning and Mullin wouldn't.

5. If Bobby was not getting enough calcium in his diet, what might happen to him?

He would have problems with his teeth and bone growth.

EVALUATION

6. If Barbara tries to go on a diet by changing all the saturated fats she has eaten before for polyunsaturated fats, will she lose weight? Why or why not?

No. Both kinds have the same amount of calories.

7. If Lázaro's mother made sure he got all the vitamins and minerals he needed, while Tina's mother paid no attention to what she ate, what might be the difference in their school attendance?

Tina would be absent more often because she would be sick more.

8. If you were a doctor who went to medical school 10 years ago, would you have taken a class in nutrition?

No.

9. Do all foods that have proteins have all the amino acids the body needs?

No. Animal proteins do, but plant proteins don't.

10. Can a person who does not eat meat or dairy products have a healthy diet? Why or why not?

Yes. He or she can get all the amino acids by combining different plant foods.

Component 3

Section One

Section Two

Section Three

MEASURE IT, CONSTRUCT IT AND ENJOY IT!

OVERVIEW

The activities of this component give the students the opportunity to learn about the need for communication and measurement skills in construction careers. The activities involve the use of both whole and decimal numbers in measuring. They require the student to add, subtract, multiply and divide to solve measurement problems. The students will make use of information they are given about selected careers and study practical career-related situations. The student will be led to recognize the importance of communication, measurement and care of equipment in these careers.

GOALS

COMMUNICATING:	The students will relate the use of measurement and communication skills to selected construction careers.
USING NUMBERS:	The student will recognize the value for the proper care, use and conservation of equipment used on the job.
MEASURING:	The students will solve problems in MKS units that involve the use of measuring equipment on tools.

LEARNING SECTIONS

SECTION 1: *Communication and Measurement in Construction*

SECTION 2: *Let's Look at Some Measuring Tools.*

SECTION 3: *Let's Do Some Measuring.*

COMPONENT III
Section One

Section One

Communication and Measurement in Construction

Learning Objective

Given four short narratives about the use of measurement and communication skills in the Construction Cluster, the student will be able to associate the work activity with the corresponding careers with 70% accuracy.

Key Words

- measurement
- communication
- meter, cubic meter
- centimeter
- amperage, temperature
- mass
- volume

Materials

- sufficient copies of narratives
- sufficient copies of evaluation

Domains and Levels

Cognitive : Knowledge, Comprehension, Application

Affective : Receiving, Responding, Valuing

IMPLEMENTATION GUIDELINES

Time: *1 Class*

STEP I - Through the use of four short narratives, the activities of workers in the following careers are presented:

Construction Contractor
Arc Welder
Crane Rigger
Mixing-Place Foreman

The narratives also present situations in which the use of measurement and communication skills are needed for the work activity.

STEP II - The student should have a general working knowledge of the terms found in the "Key Words" section.

STEP III - The teacher may read the first narrative or choose students to do the reading. The teacher may wish to give special emphasis to the first narrative to provide a model which the student may follow with the remaining narratives.

STEP IV - All questions and problems presented in the narratives should be answered by the students. The teacher may encourage discussion of the questions and help students to understand the relationship between skills in communicating and measuring and jobs in construction.

STEP V - Student should be encouraged to discuss other careers in construction and relate the importance of measurement and communication skills to the job activity.

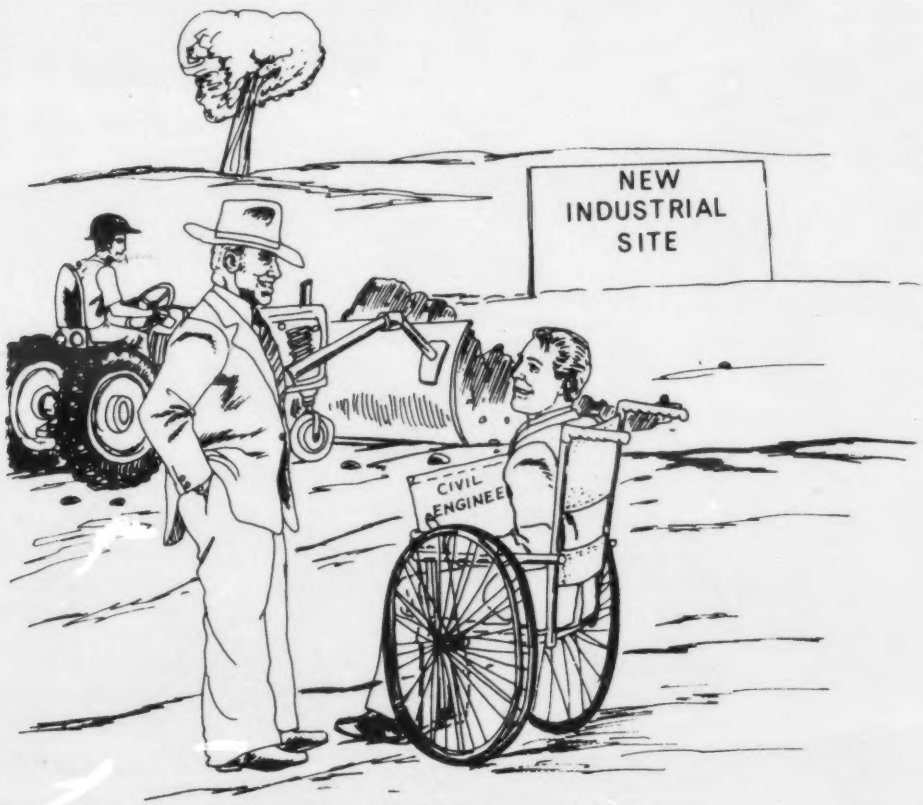
STEP VI - Evaluation

STEP VII - The Home and Community section is an optional activity and may be assigned if there is time.

STUDENT ACTIVITY MATERIAL

Construction Contractor

Carl Henson is a construction contractor for a small firm in Rolling Hills, New Mexico. A contract is an agreement about a specific job or task needed in construction. The construction of a building is carried out through contracts with plumbers, electricians and brick layers. Carl has a degree in civil engineering and is interested in management. His job involves working on a construction site. The job is to hire contractors such as heavy equipment operators, concrete contractors, steel workers, arc welders and clean-up contractors to do specific work. Carl must be sure that the jobs

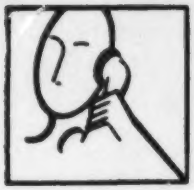


he gives contracts for are scheduled correctly during the actual construction. In other words, he must be sure the job for which the contractor has been hired is ready to be done. Carl must see that the building is constructed in the least amount of time for the least amount of money and that the building is strong and safe for people to use.

For Carl to do his job, he must be able to communicate very well with his employer and the contractors hired. He uses many styles of communication on the job. He must be able to measure materials, read blue-prints and technical manuals, write reports to his employer and contractors, and explain to his employer and contractors exactly what has been done on the construction site and what has to be done. Carl must pay close attention to detail and be able to explain this detail to the contractor.

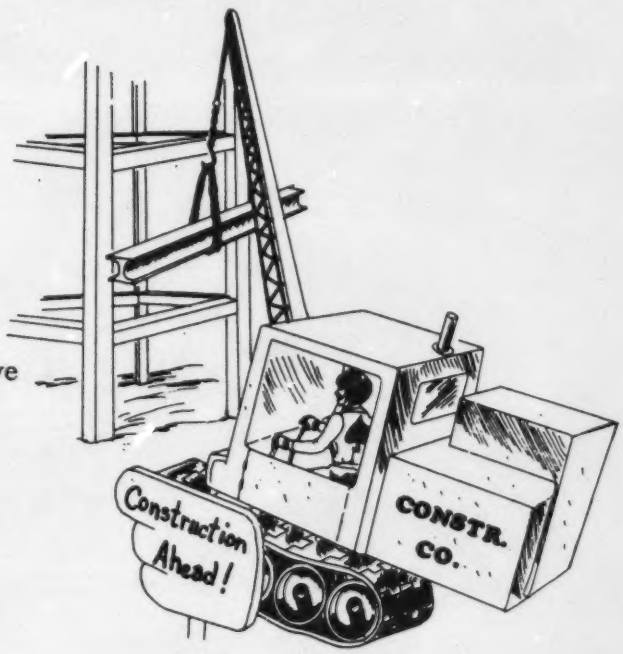
If Carl told a concrete contractor to pour a sidewalk of concrete fifty meters (50 m) long, two meters (2 m) wide and 0.1 meter (0.1 m) thick, do you think the contractors could calculate the amount of concrete he would need? How many cubic meters (m) would the contractor need?

Do you think the contractor would pour the sidewalk correctly if he were not given the measurements? What might happen? How could Carl avoid this type of problem?

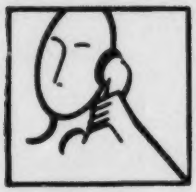


Crane Rigger

Annie McFerson is a crane rigger. Not many women work in jobs such as this. Annie's father was a construction foreman, and she learned a lot from him. She decided to work as a crane rigger because she enjoyed the job and because it paid well. She assembles pulleys and cables to move equipment or materials on the construction site. Annie selects cables, ropes, pulleys, winches, blocks and sheaves according to the mass and size of the load to be moved. Sometimes her job is dangerous, and she must wear a hard hat. Annie does her job with the aid of work orders and oral instructions from the foreman. She has to communicate with the crane operator. Annie uses hand signals, walkie-talkies and the telephone to tell the crane operator what to do next. On the construction site the crane operator and Annie use the "Don't do anything" rule. This rule states that if either rigger or crane operator does not understand the message, then "don't do anything" until it is understood.



What could happen if Annie gave the crane operator a hand signal to move a heavy load to the right and the crane operator did something different? Is communication important on Annie's job?

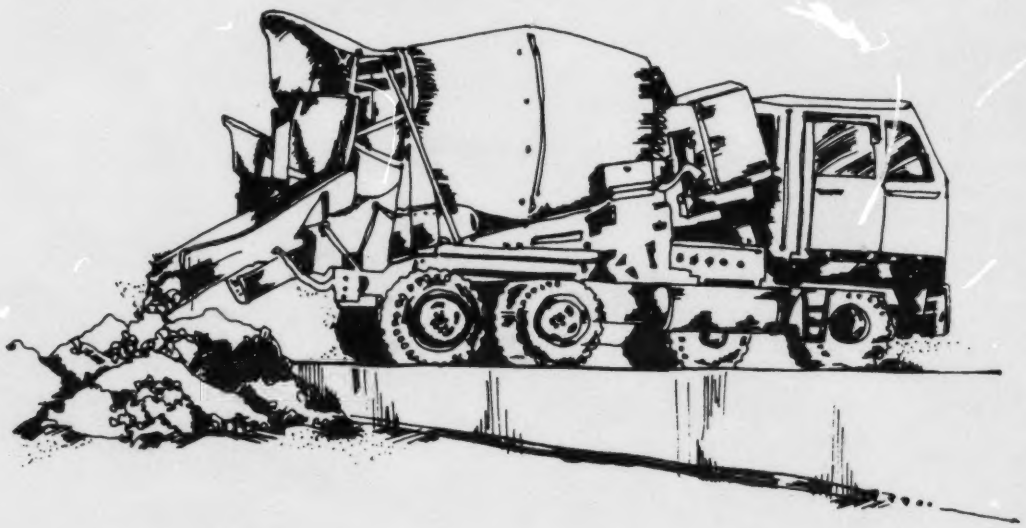


Mixing-Place Foreman

When "Big" Jake Kollins goes to work, he is thinking about rock and sand. Jake is mixing-place foreman for Ajax Concrete.

He has to be sure the right amounts of rock, sand and cement are used to make strong concrete for buildings and highways. Before Big Jake can begin his work he needs to know the volume and strength of the concrete needed at the construction site. He gets his measurements from reading blue prints and written work orders and from oral instructions from the construction site foreman. Good communication is important to Jake.

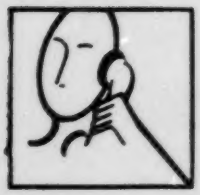
Jake supervises his mixing crew and tells them how much rock, sand, cement, and water to use for each work order. He has to be clear about the orders he gives to the crew. He also arranges for the mixed concrete to be delivered to the construction site when it is needed. Jake needs to know a great deal about the type of concrete used, how much is needed, and when to deliver it. Big Jake depends on good lines of communication.



Arc Welder

Horacio Wilder is an arc welder. He welds parts together according to blue prints, diagrams, work orders or oral instructions. He uses an electric arc welder. He must be able to follow directions that are given to him. He knows about the properties of many different types of metals and how to weld them correctly.

Electricity is very important to Horacio's job. He uses electricity to produce a hot arc to melt metal. To produce a hotter arc he has to increase the amperage on the welding machines. Different types of metal melt at different temperatures. If the temperature of the arc is too cool, then the weld will be weak and may break. If the temperature is too hot, Horacio will melt through the metal and ruin it. Horacio doesn't have these problems very often because he knows his job. When he does have a problem, it's not his welding but the kind of communication he receives from his boss about how a certain job is to be done. Communication is important to him. If the work order he receives is correct, he may misunderstand the directions. If the work order is not correct, he may follow the directions but weld the metal incorrectly. Yes, communication is important to Horacio. He needs to be able to read, write and understand instructions to do his job as an arc welder.



Construction Careers

Choose one of the careers you read about and answer these questions:

Name of Career _____

(1) What types of measurements are taken on the job?

(2) Are the measurements taken in Metric or English units?

(3) What are some of the on-the-job activities that require you to receive or send communications to accomplish your task?

(4) Do you need clear on-the-job communication to accomplish your task? Why or why not?

HOME and COMMUNITY

HOME: The students should be encouraged to talk with any member of the extended family whose work may be associated with the construction field about the use of measurements and the need for communication on the job. The activity sheet "Construction Careers" may be used by the student as an aid for this interview.

The students may also bring tools or pictures from books or magazines that display the use of measurements in the construction field.

COMMUNITY: The students may be taken on a field trip to a construction site to view first-hand the use of measurement skills. They may also be asked to note the need for communication on the job.

Students who know persons who work in construction may invite them to give a short talk about their jobs. Each student might make up a question to ask the guest.

EVALUATION

(Multiple Choice)

In the blank space provided at the left of each question or statement, place the letter which corresponds to the best answer for each question or statement.

_____ 1. What career requires the hiring of contractors to do a job on a construction site and good communication skills to tell them what to do?

A. Construction Contractor

B. Arc Welder

C. Crane Rigger

D. Mixing-Place Foreman

_____ 2. An electric arc welder is given a work order to weld a pipe together but is not told what the metal is or what the pipe is used for on the job. What should the welder do with the work order?

A. Do the work

B. Ask for more information

C. Tear the work order into pieces

D. Do the best he can.

EVALUATION

_____ 3. A crane rigger has completed the attachment of the ropes and pulleys to a crane which is to lift a heavy box to the top of a building. The rigger signals the crane operator to move the box to the left but the operator is not sure of the signal. What should the crane operator do?

A. Raise the box

B. Move the box to the left

C. Move the box to the right

D. Don't do anything and wait for another signal

_____ 4. Which career(s) below need good communication skills to do their job correctly?

A. Construction Contractor

B. Arc Welder

C. Crane Rigger

D. Mixing-Place Foreman

E. All of the above

_____ 5. If a mixing-place foreman receives a work order for highway concrete needed at 3 P.M. at the construction site on 4th street, what else does the foreman need to know?

A. When it is needed (time)

B. Where it is needed (location)

C. How much concrete is needed (volume)

D. What kind of concrete is needed (strength)

EVALUATION

Answers

Evaluation

(Multiple Choice)

In the blank space provided at the left of each question or statement, place the letter which corresponds to the best answer for each question or statement.

A 1. What career requires the hiring of contractors to do a job on a construction site and good communication skills to tell them what to do?

A. Construction Contractor

B. Arc Welder

C. Crane Rigger

D. Mixing-Place Foreman

B 2. An electric arc welder is given a work order to weld a pipe together but is not told what the metal is or what the pipe is used for on the job. What should the welder do with the work order?

A. Do the work

B. Ask for more information

C. Tear the work order into pieces

D. Do the best he can

EVALUATION

D 3. A crane rigger has completed the attachment of the ropes and pulleys to a crane which is to lift a heavy box to the top of a building. The rigger signals the crane operator to move the box to the left but the operator is not sure of the signal. What should the crane operator do?

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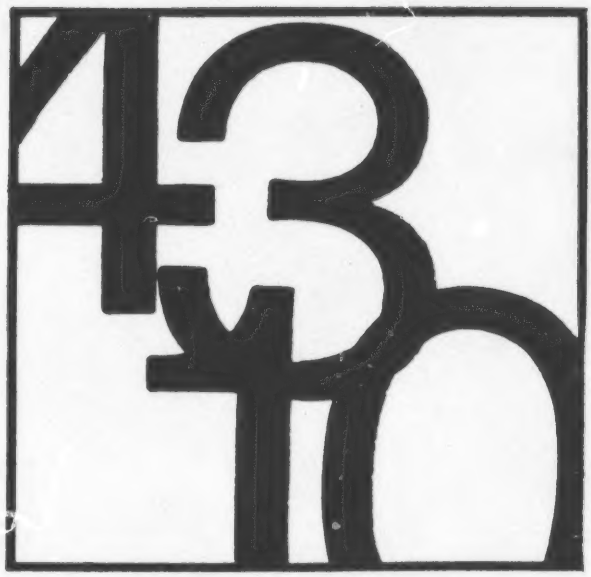


COMPONENT III

Section Two

Section Two

Let's Look at Some Measuring Tools

Learning Objective

Given a situation that presents a problem in construction, the student will use numerical relationships to solve problems, design equipment, and learn the value of equipment and its use on the job with 70% accuracy.

Key Words

- kilogram (kg)
- gram (g)
- meter (m)
- centimeter (cm)
- square meter (m^2)
- cubic meter (m^3)
- scesaw balance
- mass
- weight
- standard

Domains and Levels

Cognitive: Knowledge, Comprehension, Application, Analysis, Synthesis, Evaluation

Affective: Receiving, Responding, Valuing

Materials

- sufficient copies of the narrative and its questions.
- sufficient copies of evaluation

IMPLEMENTATION GUIDELINES

Time: *1 Class*

STEP I - The student should have the following requisite skills for this activity:

(a) Knowledge of the MKS system
(b) Ability to measure distance, area, volume and mass
(c) Ability to manipulate decimals

If the students cannot successfully complete the pre-test they will have difficulty with the activity.

STEP II - By means of a short story with dialogue, the students are presented a fictional situation in which the use of numbers and measurement is important to the task. The student should also gain the concept that equipment is valuable and should be handled with care. The story is divided into two parts. The first part may be completed in the time allotted. If more time is available, the students may complete the second part.

STEP III - This activity is best done on an individual basis, although the teacher may wish to read or have the students read the story and questions aloud but allow the student to solve the problems individually.

STEP IV Creativity is needed for some of the questions, specifically questions 2 and 15. Students should be encouraged to use their imagination, within reason, to solve these problems. Some of the questions are divergent to allow more creativity.

STEP V - At the end of the story the teacher should lead a discussion which is related to the use of numbers on the job and the conservation of equipment needed to complete assigned tasks. The following discussion questions are suggested.

(a) Does the story of Tony and Consuelo show that to do a job in a construction career the worker has to use numbers?

(b) Can the knowledge gained in studying science help a person in the construction field? Why or why not?

(c) The use of equipment and measurement tools on the job or at school helps people do the task more easily. What would be the results if the equipment or tool were misused?

STEP VI - Evaluation

STEP VII - The Home and Community section is optional and may be assigned if there is sufficient time.

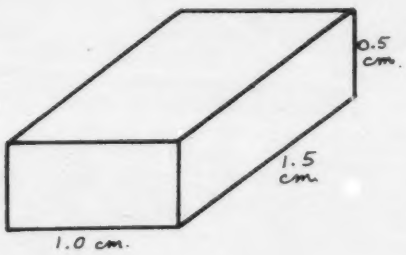
STUDENT ACTIVITY MATERIAL

Pretest

(1) 100 cm. = _____ meters

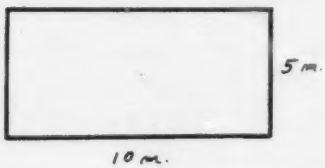
(2) 0.50 kg. = _____ grams

(3)

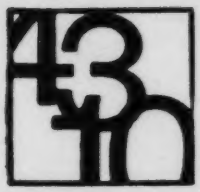


What is the volume of the box in $cm.^3$? _____ $cm.^3$

(4)



What is the area of the rectangle in $m.^2$? _____ $m.^2$



Pretest Answers

(1) 1 meter

(2) 500 grams

(3) 0.75 cm^3

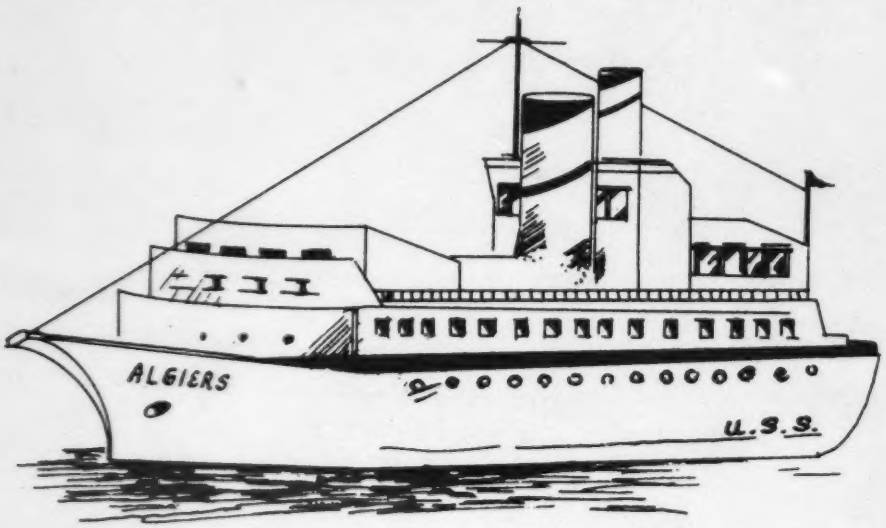
(4) 50 m^2

Introduction

The following story is a tall tale. It is exaggerated and funny. It may help you to see the use of scientific principles in construction.

The Cruise

The day was bright. A golden sun gleamed on the calm waters of the Mediterranean Sea. Tony Solvo and his wife Consuelo were sitting on the deck of the TMS Algiers sunning themselves. Tony is a carpenter



and bricklayer in Naples and Consuelo is a science teacher in the public schools. They had saved their money for years to take this cruise. They had planned this trip in every detail, or so they thought!

Suddenly, they heard an announcement from the ship's Captain. He called the passengers together to give them a frightening piece of news. A volcano in Italy had just erupted causing a tremendous earthquake, which in turn caused a tsunami (tidal wave). It was headed straight for the ship. 137

Tony: Mamma mia! What can we do?

Consuelo: Tony, don't worry. Tsunamis will not harm the ship unless we are close to land.

Just then they looked across the clear blue gleaming water and saw an island!

Consuelo: Mamma mia!

Tony: Now we are in for it.

Along with the other passengers they rushed to the nearest life jackets and put them on as the ship's horn blasted. The tsunami was beginning to rise out of the sea. It approached the island and the ship was right in the way.

Saved

The rolling of the waves was the first sound Consuelo heard when she awakened on the sandy beach. As she looked around she saw the debris from the ship scattered all over the beach. She lay there just a minute in shock. By a miracle her hand bag was lying just a few feet away. She recalled how Tony used to call it a suitcase for a pack rat. Tony! Where was he?

Consuelo: Jumping seashells! Tony! Tony!

There he was pulling himself out of the water looking like a drowned rat with his hair matted on his head. Consuelo ran toward him, relieved that he was safe.

Consuelo: Tony, Tony, I thought . . . . . .

Tony: What's for lunch? I'm starved.

Consuelo hugged him as she laughed and cried at the same time.

Tony: I almost drowned saving my pet brick.

Tony then produced a shiny wet brick from his trousers and showed it to Consuelo. The brick was the first one he ever used on the job, and he always carried it with him wherever he went. It had a mass of exactly one kilogram.

Consuelo: Crazy bricklayer!

Tony: Say, have you seen anyone else on the island?

Consuelo: No.

Tony: I think we're alone. I overheard a member of the crew say the ship's radio was broken. That means . . . . .

Consuelo: We will be here for a while.

Tony: Yes, I'm afraid so.

Tony and Consuelo sat on the beach and ate candy bars that were in the handbag. They were deciding what they had to do to live on the

island alone. The island had plenty of fruit and fresh water. As they sat there Consuelo looked through the contents of the handbag. She found the following items:

(1) a box of No. 1 paper-clips (100 paper clips)

(2) a 30 centimeter ruler (wood)

(3) knife

(4) string

Tony: I'm glad you're a pack rat!

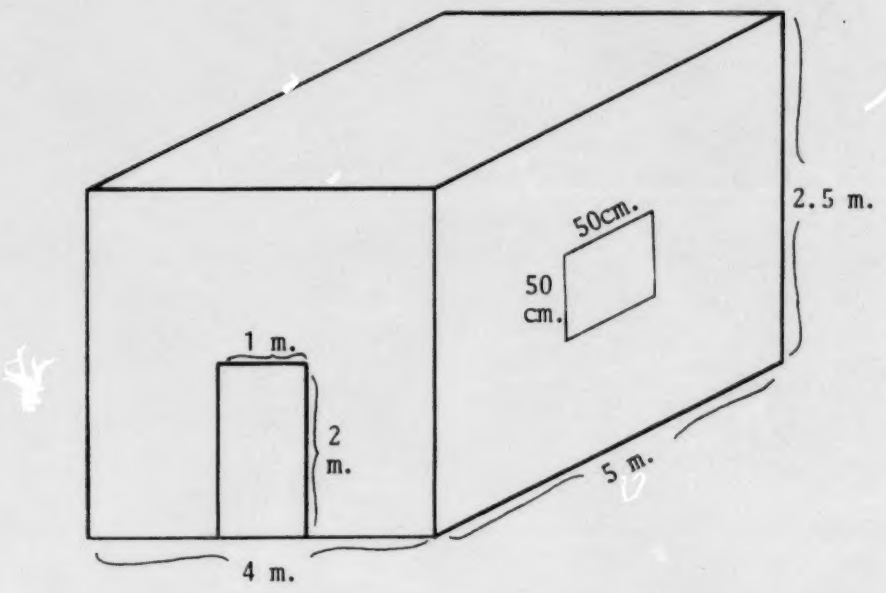
Consuelo: These are all the tools we will need to survive. We can measure distance, area, volume and mass with these simple tools. These tools are very precious and cannot be replaced, so we must take care of them to survive.

Tony: You're right. With this stuff we will have a standard to make all of our measurements on the island.

Tony and Consuelo knew that to build anything you have to be able to measure correctly or the construction may be faulty. Tony had the neccessary construction skills and Consuelo knew enough science to develop the measurement tools they would need on the island. They both knew the metric system and how to use math to solve problems.

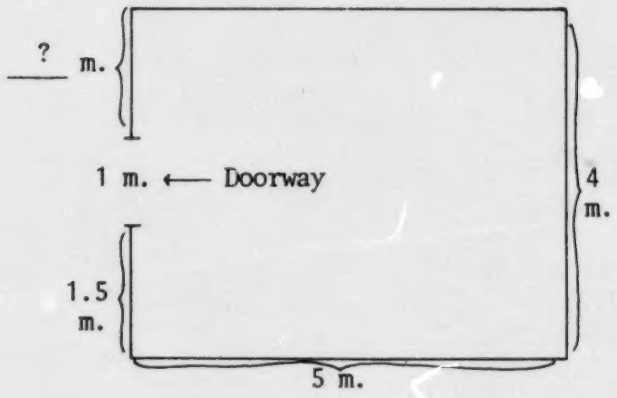
Shelter

They both decided that the first thing to do was to build a shelter. Tony decided on the following dimensions of the shelter shown on the following page:



Tony then began building the shelter out of bamboo. He first had to measure the floor for the foundation of the shelter as shown below.

Floor Plan



1. (a) What is the measurement on the side of the door in meters where Tony placed a question mark?

_____

(b) In centimeters?

_____

Just as Tony finished measuring the floor he turned around and saw a giant sea turtle eating the 30 centimeter ruler that Consuelo had given him. It was their only means of accurate measure! "Consuelo is going to be furious," he thought. "What do I do now? All I have been able to measure accurately is the floor."

2. What can Tony do to reproduce the ruler eaten by the turtle? (Use your imagination, but remember he can't get off the island or call for help.)

_____

_____

_____

3. Do you think Tony should have taken better care of the only ruler he had? Why or why not?

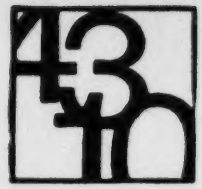
_____

_____

_____

4. How does Tony's problem compare with other construction workers who use tools and equipment on the job?

_____



Tony solved his problem by taking a straight piece of wood he found on the beach from the shipwreck. He then cut the wood with a knife to the width of the door.

5. How long was the stick he cut?

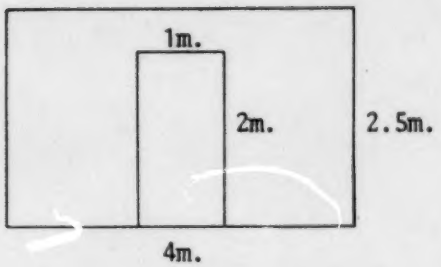
6. What does Tony believe to be true about the width of the door?

Tony then marked the stick into 100 equal parts with the knife.

7. Each part equals what unit in the metric system?

8. How many equal parts would he have to mark on the stick to show millimeters?

Tony completed his new meterstick and continued the construction of the hut. Instead of using bricks to build the walls, he had to use bamboo. He needed to know how much bamboo he would need to cut for all the walls. He decided to measure the area of each wall and then add the areas together. Tony used his plan for the hut to measure the area of the walls. He started with the front of the hut. This is what he did.



Total area of front = 4m x 2.5m. = $10m^2$

- area of the door = 1m x 2m. = $2m^2$

Area of the front = $8m^2$

9. What is the area of the side of the hut with the window, in square meters (m^2)?

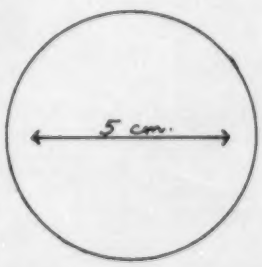
10. What is the area of the other side of the hut (it has no window), in square meters (m^2)?

11. What is the area of the back of the hut (it has no window), in square meters (m^2)?

12. What is the total area for all of the walls, in square meters (m^2)? (Hint: use your answers to questions 9, 10, 11 and the example)

Tony was curious about the volume of bamboo that was going to be cut. He estimated that each bamboo pole had a 5 cm. diameter.

13. What is the diameter of the bamboo in meters?



14. What is the approximate volume Tony will cut for the walls of the hut in cubic meters (m^3)? Hint: Use the answer to questions 12 and 13.

Tony completed the hut, and Consuelo and he moved in that same day.

Over Weight (Mass) and the Bad Back

Six months had passed and the two survivors had seen no ship. The hut had become drafty as the bamboo began to dry, crack and splinter. Consuelo was beginning to worry about her weight (mass). Her handbag was an endless supply of candy bars, and it was beginning to show.

Tony, on the other hand, had decided to use the rocks around the hut and some mud to build a rock wall for the hut to prevent drafts. But he had a weak back and the local witchdoctor had limited him to lifting only 25 kilograms to prevent an injury.

Both Consuelo and Tony were having a problem measuring mass. They remembered Tony's pet brick weighed exactly one kilogram and that Consuelo had string and a box of 100 paper clips. Each paper clip has a mass of 1 gram. They also had many rocks on the beach of different size and mass along with all of the debris washed ashore from the ship, mostly wooden boards and tin cans.

15. With the materials that are on the island, how would you measure mass? Use your imagination. Hint. 1kg. = 1000 g.

_____

_____

_____

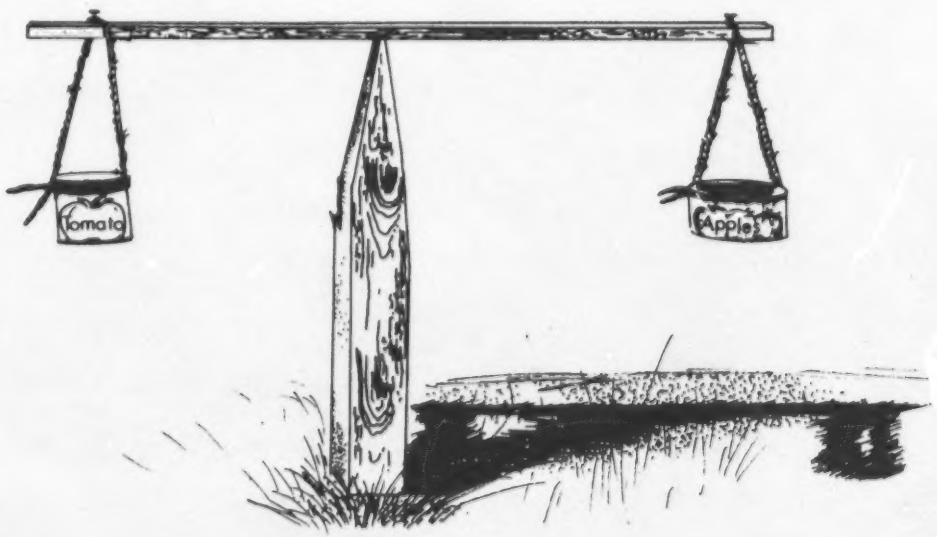
Set up a small seesaw balance and calibrate other masses from the known masses to establish a standard.

Example: 1 paper clip = 1 gram

100 paper clips = 1 hectogram (find a rock)

10 hectograms (rock) = 1 kilogram (brick), and so on.

Compare your ideas with Consuelo and Tony. They first made a small seesaw balance and attached tin cans to either side of the seesaw with string so that it would be balanced. They used a piece of drift wood with a sharp edge as a fulcrum.



They knew that 1 kg. (brick) = 100 g. (paper clips) and they only had 100 g. (paper clips). They did have a lot of rocks with different masses. They could use rocks that equal to 100 g. (paper clips) to reach 100 g. by using their balance.

16. How many 100 g. rocks would be needed in addition to the 100 paper clips they had to equal 1000g?

_____

Using many rocks to make their system of mass measurements, Tony and Consuelo devised the following list of things that were equal:

1 kg. = 1 brick

1 kg. = 100 paper clips plus 9 small rocks

1 g. = 1 paper clip

100 g. = 1 small rock

17. What is the total amount of mass in kg. that can be measured with the brick, 100 paper clips and a small rock?

_____

_____

_____

Tony and Consuelo estimated that their measurements should not go higher than 50 kg. so they used large rocks that are equal to 1 kg.

18. If they could already measure up to 2 kg. with the mass they had found, how many 1 kg. large rocks would they have to find to measure

a total mass of 50 kg?

_____

_____

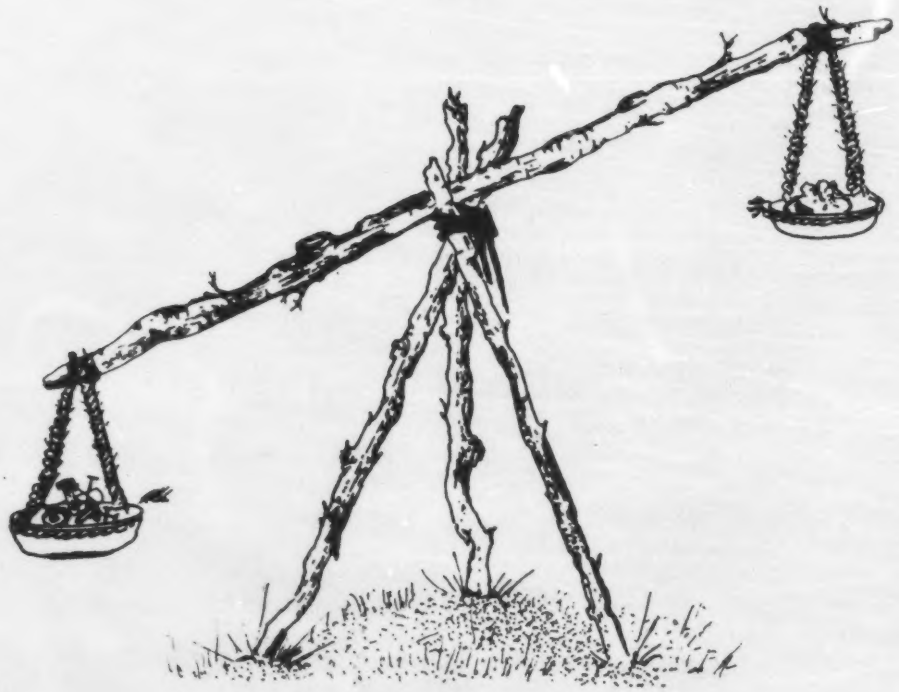
This is the complete table they made for their measurements of mass:

1 kg. = a brick or large rock

1 g. = 1 paper clip

100 g. = 1 small rock

They then built a large balance shown in the picture to measure large masses.



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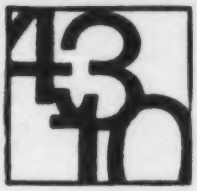


Consuelo sat in the chair on the balance they built and Tony placed the masses in the basket until it was balanced.

19. Tony placed one brick, 43 large rocks, 5 small rocks and 50 paper clips in the basket. (a) What was Consuelo's mass in kilograms? (b) In grams? (c) Is Consuelo "over mass" (overweight), as she thought?

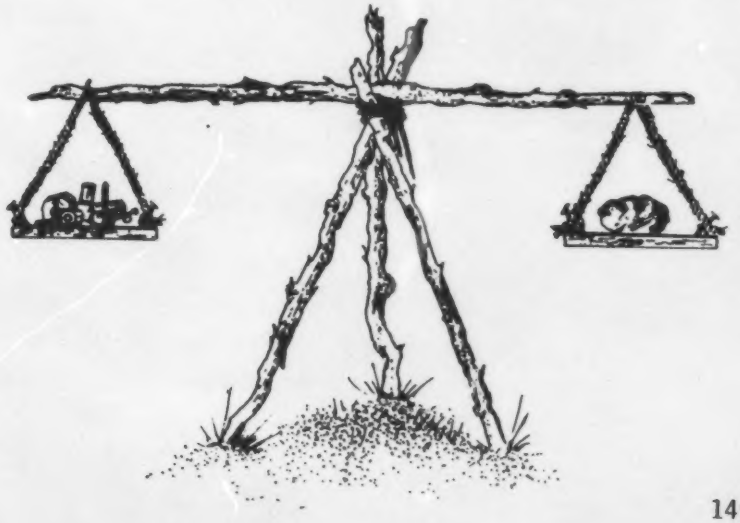
(a) _____

(b) _____

(c) _____

On the job, Tony knows that if he is injured he loses money. That is why the 25 kg. limit on what he can lift is important. Without a system of measurement he may be injured. That is not good on an island with a witch doctor that does not make house calls!

20. Using the mass system deviced by the couple, how many large rocks and a brick must Tony put in the basket on the balance to equal 25 kg?



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21. (a) What would happen to the balance if Tony places a rock less than 25 kg. on the other side of the balance? (b) What if the rock equals 25 kg? (c) What if the rock is greater than 25 kg?

(a) _____

(b) _____

(c) _____

22. How can persons in the construction industry use measurements of mass on the job to help them do their jobs better?

_____

_____

_____

Tony and Consuelo were rescued by a ship two days after that incident. They had both learned that the proper use of equipment and care of equipment affects them in many ways, on the job and off. This is the end of our tall tale. The story and characters are fictitious, but the lesson is one that may help you if you choose a construction career!

Answers to Developmental Activity

(1) (a) 1.5 m.

(b) 150 cm.

(2) Answers will vary. Tony could use the door opening which is exactly one meter and then subdivide this into centimeters and millimeters marked on the stick.

(3) Yes, he should have taken care of the ruler because it was the only one he had, and it wasted time he could have used to construct the shelter.

(4) Misuse or loss of equipment costs money and time on the job resulting also in poor measurements and construction.

(5) One meter

(6) He must believe the door is exactly one meter and that it was measured correctly.

(7) Centimeter

(8) 1000

(9) $(5m. \times 2.5m) - (.5m. \times .5m) = 12.25\ m.^2$

(10) $(5m. \times 2.5m) = 12.5\ m.^2$

(11) $(4m. \times 2.5m) = 10.0\ m.^2$

(12) $8m.^2 + 12.25m.^2 + 12.5m.^2 + 10.0m.^2 = 42.75\ m.^2$

(13) 0.05 m.

(14) $42.75m^2 \times 0.05m. = 2.1375 = 2\ m^3$

(15) Answers may vary, but the student may have them build a simple balance and establish a standard of measure from the knowns.

1 paper clip = 1 gram

100 paper clips = 1 hectogram (a found rock)

10 hectograms = 1 kilogram (brick)

(16) 9 rocks, 100 grams each

(17) 2 kilograms

(18) 48 large one kilogram rocks

(19) a. 44.55 kg.

b. 44550 g.

c. Probably not

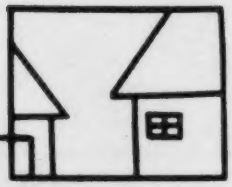
(20) 1 brick and 24 large rocks

(21) a. Nothing

b. It would balance

c. Raise the weights into the air

(22) Safety is enhanced when the mass of an object is known, such knowledge may decrease back injuries and strain, wear and tear on equipment from overloading.



HOME and COMMUNITY

The student will ask their family members about the use of numbers on the job, and if the handling of equipment, in the correct manner, has an impact on the construction field.

The students may also take a field trip to a construction site with an interview of a carpenter, brick layer, electrician, etc. The interview should be concerned with the use of numbers on the job and the proper care and maintenance of equipment and its impact on each interviewer's job.

EVALUATION

In the space before each statement given below, place a (T) for true or an (F) for false.

_____ 1. Knowledge gained in science helps construction workers on the job.

_____ 2. Jobs in construction require the people to use numbers.

_____ 3. Measurement of mass on the construction site can prevent accidents.

_____ 4. Equipment and tools on the job are cheap and do not need any care.

_____ 5. The measurement of distance, area and volume are not used on construction sites.

_____ 6. A standard measure, such as the meter, helps to build a better building.

_____ 7. Science skills you learn in the classroom cannot help you on the job.

EVALUATION

Answers

1. T
2. T
3. T
4. F
5. F
6. T
7. F

COMPONENT III

Section Three

Section Three
Let's Do some Measuring

Key Words

- nuclear
- radiation
- kilometer, km
- cubic meter, m^3
- cubic centimeter, cm^3
- metric ton, T
- area
- volume
- Newton
- force
- gravity

Learning Objective

Given a descriptive situation related to careers in construction, the student will display an understanding of MKS measurement by solving problems and describing the results of incorrect measurements in the situation according to the criteria the teacher establishes.

Materials

- sufficient copies of activity for each student
- sufficient copies of evaluation for each student

Domains and Levels

Cognitive: Knowledge, Comprehension, Application, Analysis, Synthesis

Affective: Receiving, Responding, Valuing

IMPLEMENTATION GUIDELINES

Time: *1 Class*

STEP I - Students working on this activity should have a general knowledge of the MKS system of measurement including distance, area, volume mass, force, voltage and amperage. A general introduction to Newton's second law of motion may also aid the student.

STEP II - The teacher should introduce this activity by asking questions to help students realize that the correct use of measurement in construction is essential and that the selection of a proper MKS unit aids in the measurements. Suggested questions are as follows:

a). How does a construction worker use measurement?

Answer: He has to be sure the proper amount of materials are available to perform his job. Proper measurement can save money. Improper measurement may result in waste and possible injury. He should also select the proper measuring tools and unit of measurement.

b). How does an electrician use measurements?

Answer: He measures wires, electric voltage and current.

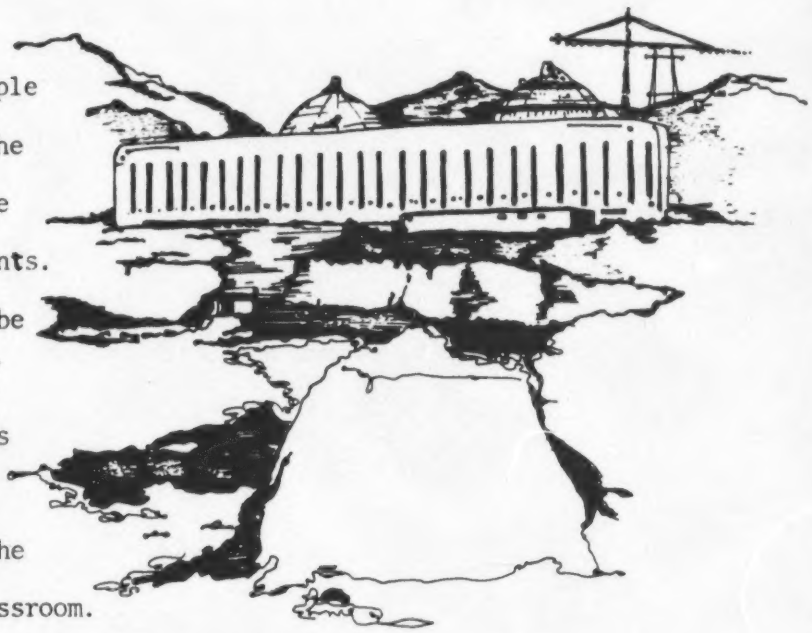
c). What may happen if an electrician makes the wrong measurement?

Answer: The circuit may not work. The circuit may overheat and burn the building, resulting in loss of property and life.

STEP III - The teacher may wish to read the descriptive situations included in the activities aloud and have the class solve the problems and present the answers orally. Further explanation and examples may be given by the teacher. Variations in students' answers to problems should be discussed in class. The impact of the student's answers on the situation should be reviewed as: "What would happen if your answer were used?"

STUDENT ACTIVITY MATERIAL

Nuclear Construction



Nuclear energy has been in the news. Many people have been concerned about the effects of radiation and the safety of nuclear power plants. Both of these concerns can be related to the construction field. Nuclear power plants have to be built by people just like you and me with the knowledge gained in the classroom.

A nuclear power plant is made up of steel and concrete. There are several types of power plants, but the one in this activity is called a Pressure Water Reactor. The main part of this power plant is called a Containment Building. This building must be made very strong and safe to hold the nuclear reactor inside. In case of an accident, such as an explosion inside the reactor upon a jet liner hitting the building, the containment building must not be damaged. This building must meet two needs:

1. The containment building should protect people, animals and plants from the radiation inside.
2. The containment building should protect the reactor from the outside environment in case of accidents, such as tornados, earthquakes and explosions.

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The containment building is made of steel and concrete. It takes about 6400 metric tons of steel reinforcing rods which are about 6 centimeters in diameter to build it. If you connected all of the reinforcing rods end to end, they would be about 85 kilometers long. About 12,500 cubic meters of cement is used in this building. It would take 1250 concrete trucks carrying 10 cubic meters each to bring in all of this concrete. Inside the containment building the walls are covered with steel plates two centimeters thick and are welded to make the building air tight and prevent any radiation from leaking out. Construction workers, like the mixing-place foreman, crane riggers and arc welders, must do a good job to insure a well-constructed building to house the reactor.

1) If the mass of the steel used in the building is 6400 T and 1000 kg. = 1 T, how many kilograms of steel are used in this construction?

2) If each cement truck can carry 10 cubic meters of concrete and 1 $m.^3$ = 1,000,000 $cm.^3$, how many cubic centimeters does a cement truck carry on each trip?

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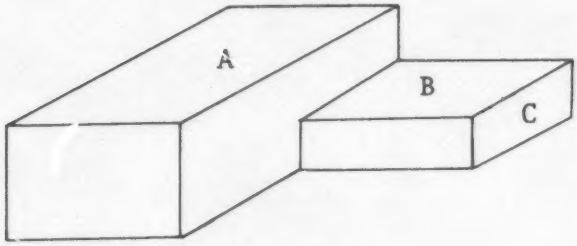
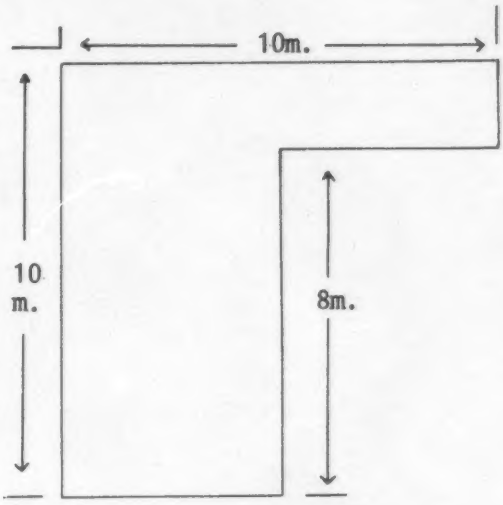
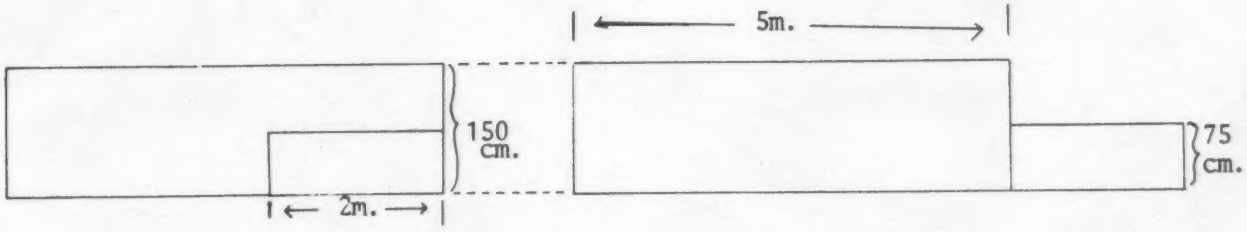
Big Jake is the mixing-place foreman at the nuclear power plant. His job requires him to measure the correct amount of concrete needed on each phase of construction and see that the concrete is mixed correctly. Jake must be sure his measurement is correct. He must not mix too much or too little concrete. Jake made the measurements shown below for the nuclear reactor pad.



Full view



Top view



Side view

End view

From the pictures Jake drew, he needs to find the area of A, B & C on the full view.

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3) What is the area of A in m^2?

4) What is the area of B in m^2?

5) What is the area of C in m^2?

6) Jake now needs to find the volume in m^3 of the largest concrete block. What is the volume?

7) Jake then solved for the volume of the smaller cement block in m^3. What did he find?

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8) What is the total volume Jake will need to mix in concrete to pour the nuclear reactor pad?

9) How many cement trucks will he need to deliver the cement if each truck carries about 10 m^3 of concrete? Does the last truck carry a full load of concrete?

The crane rigger, Annie McFerson, has the responsibility of moving all the concrete delivered to the nuclear power plant. She works with the crane operator to hoist the concrete with a large carrying bucket from the delivery truck to the pouring site. The buckets are attached to the crane by a cable. The cable has been tested to withstand a force of 25,000 newtons (n). The bucket Annie will use on the job can hold 2 cubic meters of concrete.

Annie knows that one cubic meter of concrete has a mass of 1300 kg. and she knows Newton's 2nd law which says:

Force (n) = Mass (kg.) times Gravity (10m./sec.^{2})

Using Newton's 2nd law, Annie found the following information about 1m^3 of concrete.

Force (n) = 1300 kg. x 10 m/sec^2 Force of 1 m^3 = 13000 n.

Annie now knows that 1 cubic meter of concrete is equal to a force of 13,000 newtons. Since 13,000 n. is less that 25,000 n. the cable will not break.

10). What is the force in newtons of the cement if 2 m.^{3} are placed in the bucket? (Hint: 1 m.^{3} = 1300 kg.)

11). Will the cable break if Annie loads the bucket with 2 m.^{3} of concrete?

An arc welder works on DC current and produces very hot temperatures. It works very similar to a copper wire attached to both poles on a battery. The wire gets very hot due to the DC current in the battery and looks similar to the sparkler used on holidays. The arc welder is a little more complicated. The flow of the electricity, amperage, can be controlled to increase the heat on the electrode. The electrode looks like a soda straw but is made of metal which gets hot and melts, like the copper wire on a battery. Miguel's machine has a constant voltage so he doesn't think much about that when he is welding. Miguel can change the amperage on his welder, and he does this to correct for the size of electrode he is using on the weld. Electrodes are measured in millimeters across their diameter.

The larger the diameter of the electrode, the more amperage is needed. Miguel uses the graph shown below to find the amperage he must use. If the amperage is too high the electrode will melt quickly or if too low it will melt slowly. Both conditions will cause an improper weld.

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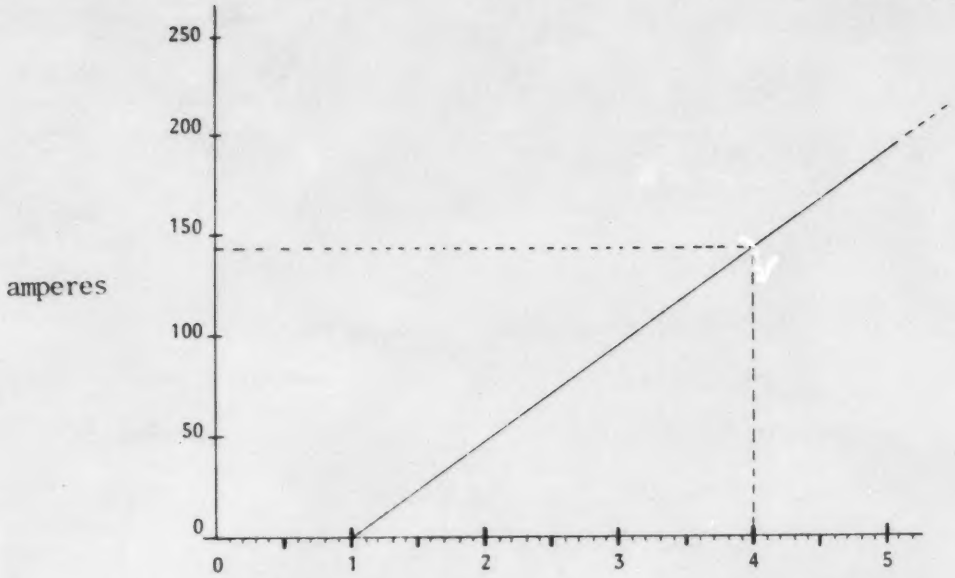

Miguel had a four millimeter electrode, so he used the graph to find the amperage he needs to use. He decided that the amperage should be about 140 amperes to make the correct weld.

14. What amperages should he use for the following sizes of electrodes?

	electrode diameter	amperage
A	2.0 mm.	
B	5.3 mm.	
C	2.4 mm.	
D	4.5 mm.	

15). What could happen at the nuclear power plant if Miguel did not use the correct amperage for an electrode?

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Nuclear Construction
Answer Key

1) 6,400,000 kg

2) 10,000,000 cm^3

3) 10m x 5m = 50 m^2

4) 5m x 2m. = 10 m^2

5) 2m x .75m. = 1.5 m^2

6) V = 10m x 5m x 1.5m = 75 m

7) V = 2m x .75m x 3 m^3

8) V = 75m^3 + 3m^3 = 78 m^3 (total)

9) Eight trucks with the last truck carrying only 8 m^3.

No

10. Force (n) = 2(1300 kg) x 10m/sec^2
n = 26,000 n

11. Yes

12. Mass (kg) = $\frac{25{,}000\ n}{20m/sec^2}$

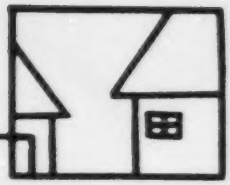
= 2500 kg

13. Yes. The measurement of force and mass enables Annie to make decisions about the capacities of the equipment and its safe operation.

14. What amperages should he use for the following sizes of electrodes?

	electrode diameter	amperage
A	2.0 mm.	about 50
B	5.3 mm.	about 200
C	2.4 mm.	about 75
D	4.5 mm.	about 160

15. The weld would be defective and a radiation leak may occur.



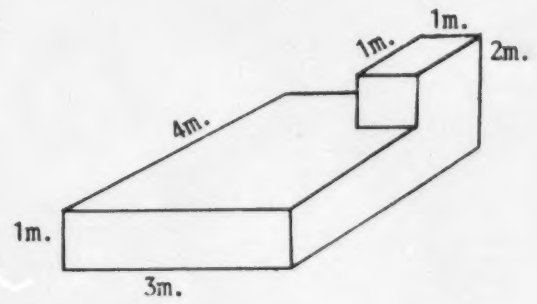
HOME and COMMUNITY

The students may ask members of their family about the use of measurement on the job and what would be the results of an incorrect measurement. If members of the family do not deal with construction, the use of measurement can be extended to measurements relating to cooking, automobile speed or any application in which an improper measurement. may result in an unwanted outcome.

The students may ask their neighbors or other members of the community about the use of measurement and its importance. A speaker from local engineering groups or construction firms can be asked to discuss measurements done on the job and show how errors have resulted in problems in construction.

EVALUATION

1) Big Jake received a new order for concrete on the nuclear power plant. He must be sure he has enough concrete to pour and not run out. He makes the following measurements below.



a). What is the volume in m^3 of concrete Jake will need?

_____

_____

b). What can happen if Jake does not make the correct measurements?

_____

_____

_____

2). Annie is rigging a crane to lift steel reinforcing rods to the top of the nuclear power plant. The cable she has on the crane will lift 50,000 n of force. Each steel rod has a force of 10,000 n. What is the maximum number of steel rods she can hoist by the crane?

_____

What may happen if Annie places too many steel rods on the crane?

_____

_____

EVALUATION

3). Miguel was welding the steel panels in the nuclear containment building and ran out of the small diameter electrodes. He started using a large diameter electrode but did not correct the welder for the proper amperage. What may be the results of Miguel's mistake?

_____

_____

_____

ANSWERS

1). a). $V = (3m. \times 1m. \times 4m.) + (1m. \times 1m. \times 1m.) = 13m.^3$

b). One of two conditions exists:too much concrete is produced and wasted, 2) not enough concrete is produced and the job is faulty as a result.

2). What is the maximum number of steel rods she can hoist by the crane?

(5,000 ÷ 10,000 = 5 steel rods)

What may happen if Annie places too many steel rods on the crane?

The cable may break and someone may be injured.

3). An improper weld will result and radiation contamination may result in the future.